Sealing The Gap
In Oral Health Disparities

The Burden of Oral Disease in South Carolina

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I. Introduction

The mouth is our primary connection to the world. It is how we take in water and nutrients to sustain life, our primary means of communication, the most visible sign of our mood, and a major part of how we appear to others. Oral health is an essential and integral component of overall health throughout life and is much more than just healthy teeth. Oral refers to the whole mouth, including the teeth, gums, hard and soft palate, linings of the mouth and throat, tongue, lips, salivary glands, chewing muscles, and upper and lower jaws. Not only does good oral health mean being free of tooth decay and gum disease, but it also means being free of chronic oral pain conditions, oral cancer, birth defects such as cleft lip and palate, and other conditions that affect the mouth and throat. Good oral health also includes the ability to carry on the most basic human functions such as chewing, swallowing, speaking, smiling, kissing, and singing.

The mouth is an integral part of human anatomy and plays a major role in our overall physiology. Thus, oral health is intimately related to the health of the rest of the body. Mounting evidence suggests that infections in the mouth such as periodontal (gum) diseases may increase the risk of heart disease, may put pregnant women at greater risk of premature delivery, and may complicate control of blood sugar for people living with diabetes. Conversely, changes in the mouth are often the first signs of problems elsewhere in the body, such as infectious diseases, immune disorders, nutritional deficiencies, and even cancer.

This report summarizes the most current information available on the oral disease burden of people in South Carolina. It also highlights groups and regions in our state that are at highest risk of oral health problems and discusses strategies to prevent these conditions and provide access to dental care. Comparisons are made with national data whenever possible and to the *Healthy People 2010* objectives where appropriate. For some conditions, national data, but not state data, are available at this time. It is hoped that this information will help raise awareness of the need for monitoring the oral health burden in South Carolina and guide efforts to prevent and treat oral diseases and enhance the quality of life of South Carolina's residents.

II. Executive Summary

Two goals of the nation's guiding public health document, *Healthy People 2010*, are (1) to eliminate disparities in access to health care and health outcomes and (2) to increase quality of life. Oral health is a significant contributor to overall health; to increase quality of life across the life span, South Carolina must improve the oral health of its citizens. Most common oral diseases and conditions can be prevented. Although gains in oral health status have been achieved for the population as a whole, they have not been evenly distributed across subpopulations. Dental caries, a largely preventable disease, disproportionately affects racial and ethnic minorities, people who are poor, individuals living in rural communities and people with special health care needs (IOM Report 2011)

Oral health and general health are integral to each other. Many systemic diseases and conditions including diabetes, HIV, and nutritional deficiencies, have oral signs and symptoms. These manifestations may be the initial sign of clinical disease and may serve to inform health care providers and individuals of the need for further assessment. Recent research suggests linkages between oral health and diabetes, respiratory disease and cardiovascular disease (IOM Report 2011).

The South Carolina State Oral Health Plan. In an effort to address and respond to the oral health issues in the state, the Division of Oral Health (DOH) at the South Carolina Department of Health and Environmental Control (DHEC), in collaboration with the Oral Health Advisory Council and Coalition developed the South Carolina State Oral Health Plan (SOHP). The process to develop this plan was facilitated by an external evaluator at the University of South Carolina's Arnold School of Public Health, Department of Health Services Policy and Management. Once the plan was developed, the Division of Oral Health staff, along with members of the SC Oral Health Advisory Council and Coalition, implements the objectives within the plan. Through workgroup meetings, the South Carolina Oral Health Advisory Council and Coalition (SCOHACC) continually develop, update, modify, and evaluate the progress of objectives and activities. Each workgroup has ownership over specific sections of the plan.

Significant Findings of this Report:

Oral Disease and Prevention

Although the state 2008 Oral Health Needs Assessment and BRFSS show some progress in improving the oral health of residents of South Carolina, a great deal of work remains to be done, especially among members of special populations. Women, minorities, and those living in low-income families have poorer outcomes than the norm. There has been no surveillance data gathered on teenagers, the elderly, or persons with disabilities.

The statewide 2008 Oral Health Needs Assessment show that South Carolina's third graders are more likely to have experienced tooth decay than other third graders in the United States. It also revealed that South Carolina third graders are less likely to have sealants on their molars than third graders in other states.

South Carolina has exceeded the goal of having 75 percent of those on public water systems receive fluoridated water; it ranks 11th in the nation, with 93.8 percent of public water systems dispensing fluoridated water.

Comorbid Conditions

Due to the high prevalence of tobacco use in this state (more than twice the national rate in some populations), South Carolina has a disproportionately high rate of oral cancer incidence and mortality. South Carolina also has disproportionately high rates of cardiovascular disease and diabetes, which can exacerbate oral disease conditions.

Surveillance

The DOH is currently working with the Office of Research and Statistics (ORS) to design and implement a statewide oral health monitoring system. The implementation of South Carolina's third Oral Health Needs Assessment was completed in February 2013. The data is being analyzed and evaluated with plans to disseminate the data results and make needed revisions and accommodations to oral health initiatives to meet the needs of the state.

Ongoing Programs

South Carolina's Comprehensive Health Education Act of 1988 (CHEA) includes dental health as a part of the kindergarten to grade five module. For middle and high school students, substance use (tobacco) also is a part of the curriculum.

The South Carolina School Dental Prevention Program (SDPP) enrolls public and private providers who agree to provide school-based oral health services in their local community and to operate within the *School-Based Dental Prevention Program Guidelines*. The program was active in 31 of South Carolina's 46 counties in 2011-2012 reaching 401 schools in 49 school districts. In 2011-2012 fiscal year in South Carolina there were 265 Community–based Health Centers and 54 of them were Community-Based dental clinics that includes Community Health Centers (CHC), hospitals and other facilities that provide free or reduced dental services to population. According to the South Carolina Primary Health Care Association website, there are 19 Federally Qualified Health Centers (FQHCs) and one (1) statewide Migrant Health Voucher Program and seven (7) of them offering dental services.

III. National And State Objectives On Oral Health

National Objectives on Oral Health

Oral Health in America: A Report of the Surgeon General (the *Report*) alerted Americans to the importance of oral health in their daily lives (USDHHS 2000a). Issued in May 2000, the report further detailed how oral health is promoted; how oral diseases and conditions are prevented and managed; and what needs and opportunities exist to enhance oral health. The report's message was that oral health is essential to general health and well-being and can be achieved. However, several barriers hinder the ability of some Americans to attain optimal oral health. The Surgeon General's report concluded with a framework for action, calling for a national oral health plan to improve quality of life and eliminate oral health disparities.

One component of an oral health plan is a set of measurable and achievable objectives based on key indicators of oral disease burden, oral health promotion, and oral disease prevention. One set of national indicators was developed in November 2000 as part of *Healthy People 2010,* a document that presents a comprehensive, nationwide health promotion and disease prevention agenda (USDHHS 2000b). *Healthy People 2010* is designed to serve as a roadmap for improving the health of all people in the United States during the first decade of the 21st century. Included are objectives for key structures, processes, and outcomes related to improving oral health. These objectives represent the ideas and expertise of a diverse range of individuals and organizations concerned about the nation's oral health.

The Surgeon General's report on oral health was a wake-up call, that spurred policy makers, community leaders, private industry, health professionals, the media, and the public to affirm that oral health is essential to general health and well-being and to take action. That call to action led a broad coalition of public and private organizations and individuals to generate *A National Call to Action to Promote Oral Health* (USDHHS 2003). The vision of the *Call to Action* is "To advance the general health and well-being of all Americans by creating critical partnerships at all levels of society to engage in programs to promote oral health and prevent disease." The goals of the *Call to Action* reflect those of *Healthy People 2010*:

- To promote oral health
- To improve quality of life
- To eliminate oral health disparities

National objectives on oral health such as those in *Healthy People 2010* provide measurable targets for the nation, but most core public health functions of assessment, assurance, and policy development occur at the state level. The *National Call to Action to Promote Oral Health* calls for the development of plans at the state and community levels, with attention to planning, evaluation, and accountability (USDHHS 2003). The *Healthy People 2010* oral health objectives for the nation and the current status of each indicator for the United States and for South Carolina are summarized in Table I.

Table I. *Healthy People 2010* Oral Health Indicators, Target Levels, and Current Status in the United States and South Carolina

Healthy People 2010 Objective (Objective Number and Description)	Target (%)	Baseline (%)	Final US (%)	South Carolina Status* (%)
21-1) Dental caries experience				
Children, aged 6–8 years	42	52 (1988–94)	53 (1999-2004)	51.9 (2008)
21-2) Untreated caries				
Children, aged 6–8 years	21	28 (1988–94)	29 (1999-2004)	22.8 (2008)
21-3) Adults with no tooth loss, aged 35–44 years	40	30 (1988–94)	38 (1999-2004)	57.5 (2010)
21-4) Complete tooth loss in older adults, aged 65–74 years	22	29 (1988–94)	24 (1999-2004)	21.6 (2010)
21-6) Oral and pharyngeal cancers detected at earliest stages, all	51	36 (1992–95)	33 (2006)	32[c]
21-7) Annual examinations for oral and pharyngeal cancers in adults (age adjusted, 40+ years)	20	13 (1998)	18 (2008)	23.5%*
21-8) Dental sealants				
Children, aged 8 years (first molars)	50	23 (1988–94)	32 (1999-2004)	24.2 (2008)
21-9) Water Fluoridation				
Population receiving optimally fluoridated water	75	62 (1992)	72 (2012)	94[e]
21-12) Annual Preventive Dental visit for low income children under 19 years	66	25 1996	31 2008	n/a
21-14) Community based health centers and local health departments with oral health components, all	75	52 (1997)	75 (2012)	20

DATA SOURCES
21-1a–c. National Health and Nutrition Examination Survey (NHANES), CDC, NCHS; SC Oral Health Needs Assessment 2008
21-2a–d. National Health and Nutrition Examination Survey (NHANES), CDC, NCHS; SC Oral Health Needs Assessment 2008
21-3–21-4. National Health and Nutrition Examination Survey (NHANES), CDC, NCHS; SC BRFSS 2010
21-6. Surveillance, Epidemiology, and End Results (SEER) Program, NIH, NCI;
21-7. National Health Interview Survey (NHIS), CDC, NCHS; SC BRFSS 2006 *Question: ever had an oral cancer exam
21-8a. National Health and Nutrition Examination Survey (NHANES), CDC, NCHS; SC Oral Health Needs Assessment 2008
21-9. CDC Fluoridation Census, CDC, NCCDPHP.
21-12. Medical Expenditure Panel Survey (MEPS), AHRQ.
21-14. HRSA, Bureau of Primary Health Care.

South Carolina Takes Action- State Oral Health Plan

Healthy People 2010 calls for the elimination of disparities in access to health care and health outcomes and increasing quality of life. These goals are reflected in the Strategic Plan for the SC DHEC, and also in the SOHP published by the DOH. Oral health is a significant contributor to overall health; to increase quality of life, South Carolina must improve the oral health of its citizens. Before improving the oral health of its citizens, South Carolina must reduce or eliminate the disparities in access to care and treatment that contribute to the increased burden of oral disease among minority populations.

The SCOHACC's first priority for enhancing the SOHP was to strengthen their ability to affect policy and advocacy. Therefore the first chapter developed was Chapter 1: Leadership and Infrastructure. Subsequent chapters address South Carolina's (SC) plan to strengthen the infrastructure and capacity to plan, implement and evaluate the state oral disease program and population-based oral disease prevention interventions. Chapter 2: Surveillance addresses the implementation and evaluation of a comprehensive oral health surveillance system for SC. The two recommended oral disease interventions supported by the Community Guide to Preventive Services, community water fluoridation and school-based sealant programs, are addressed in Chapter 4: Water Fluoridation and Chapter 7: Special Populations: II. Public School Children respectively as well as in Chapter 2: Surveillance. A DOH staff member provides technical assistance and staff support to each Chapter workgroup. Other Chapters that have been prioritized are: Chapter 3: Social Marketing; Chapter 5: Workforce; Chapter 6: Chronic Disease: Oral Cancer; and Chapter 7: Special Populations: including I. Children with Special Health Care Needs; III. Early Childhood; and IV. Older Adults. The full text of the state plan for oral health is available at: www.scdhec.gov/health/mch/oral/plan.htm

PRECEDE-PROCEED Model

The State Oral Health Plan for South Carolina is structured on the PRECEDE-PROCEED model of community assessment and program implementation (Green and Kreuter, 2004). The PRECEDE-PROCEED model was developed to provide a framework for developing, implementing, and evaluating health interventions. The model is divided into eight phases, split into two parts: the PRECEDE (Predisposing, Reinforcing, and Enabling Constructs in Educational/Ecological Diagnosis and Evaluation) model, comprising phases one through four; and the PROCEED (Policy, Regulatory, and Organizational Constructs in Educational and Environmental Development), comprising phases five through eight (See Figure 1 & Figure 2).

Figure 1. **GENERAL THEORETICAL FRAMEWORK (Green and Kreuter, 1999)**

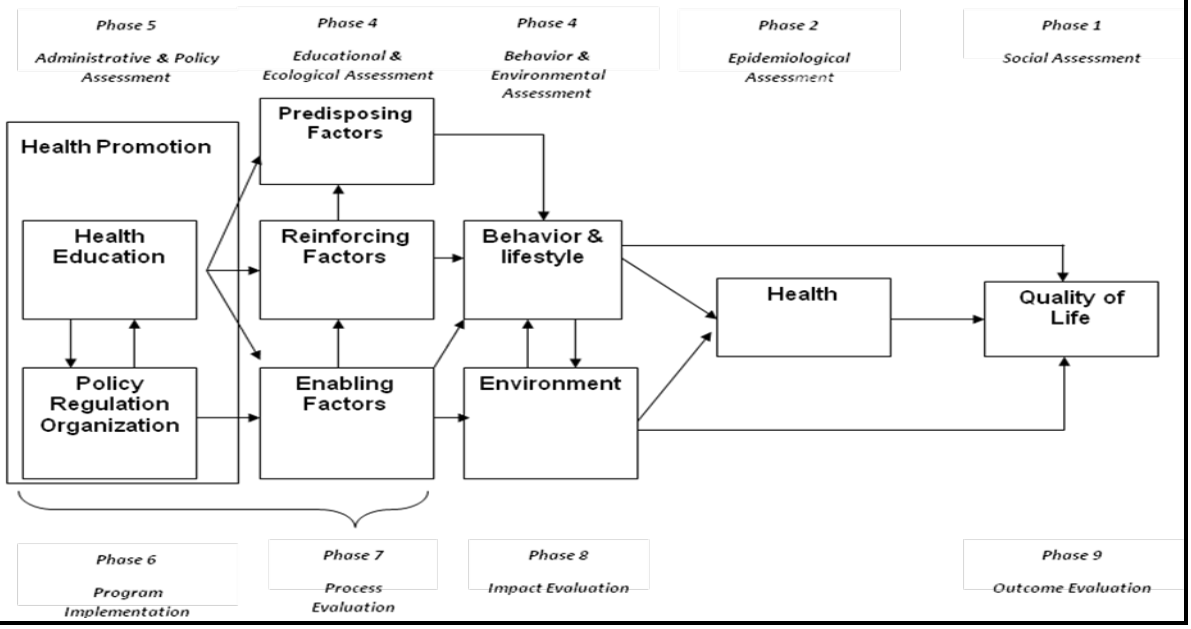
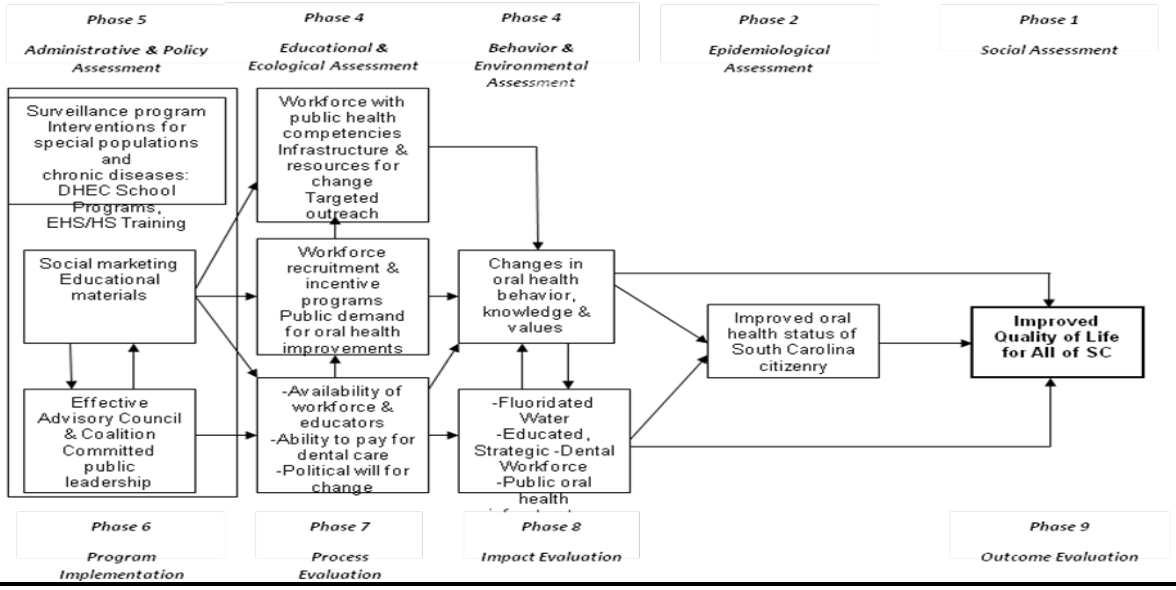


Figure 2. **SOUTH CAROLINA EVALUATION FRAMEWORK**



This document is primarily concerned with the first half of the model, PRECEDE. Phase one begins by assessing the quality of life of the general population; phase two expands this assessment by including epidemiological data relating to the health outcome in question, including genetic and behavioral factors. In phase three, broader individual and community factors that contribute to the health outcome are explored. Phase four looks at policy implications on proposed health intervention programs, as well as covering the resources needed (human, fiscal, and spatial) for implementation of the program.

The second half of the model, PROCEED, covers the actual implementation of health intervention programs and evaluations of their outcomes. Each of the four phases in PROCEED corresponds with specific phases of PRECEDE. Phase five, the implementation of a health intervention program, is directly linked to phase four (the resources needed for implementation). Phases six, seven, and eight allow for evaluation of the program at the individual, program, and population levels.

This model provides a framework for the design and implementation of most health promotion interventions. It requires the program designer to examine the health issue not only from the standpoint of implementation, but also from "before" and "after" views: is this health program really essential, based on the health needs of the population? After implementation, did the health program have an effect on the health of the general population?

This document explores the quality of life of South Carolinians with respect to their oral health (phase one of PRECEDE), provides data on the local and national burden of oral disease (phase two), and looks briefly at some of the behavioral, environmental, and other factors which lead to poor oral health in South Carolina (phases three and four).

Healthy People 2020

In December 2020, Healthy People 2020 set a ten year agenda for improving the nation's heath. The vision for this effort is "a society in which all people live long, healthy lives. To achieve the vision, HP2020 strives to:

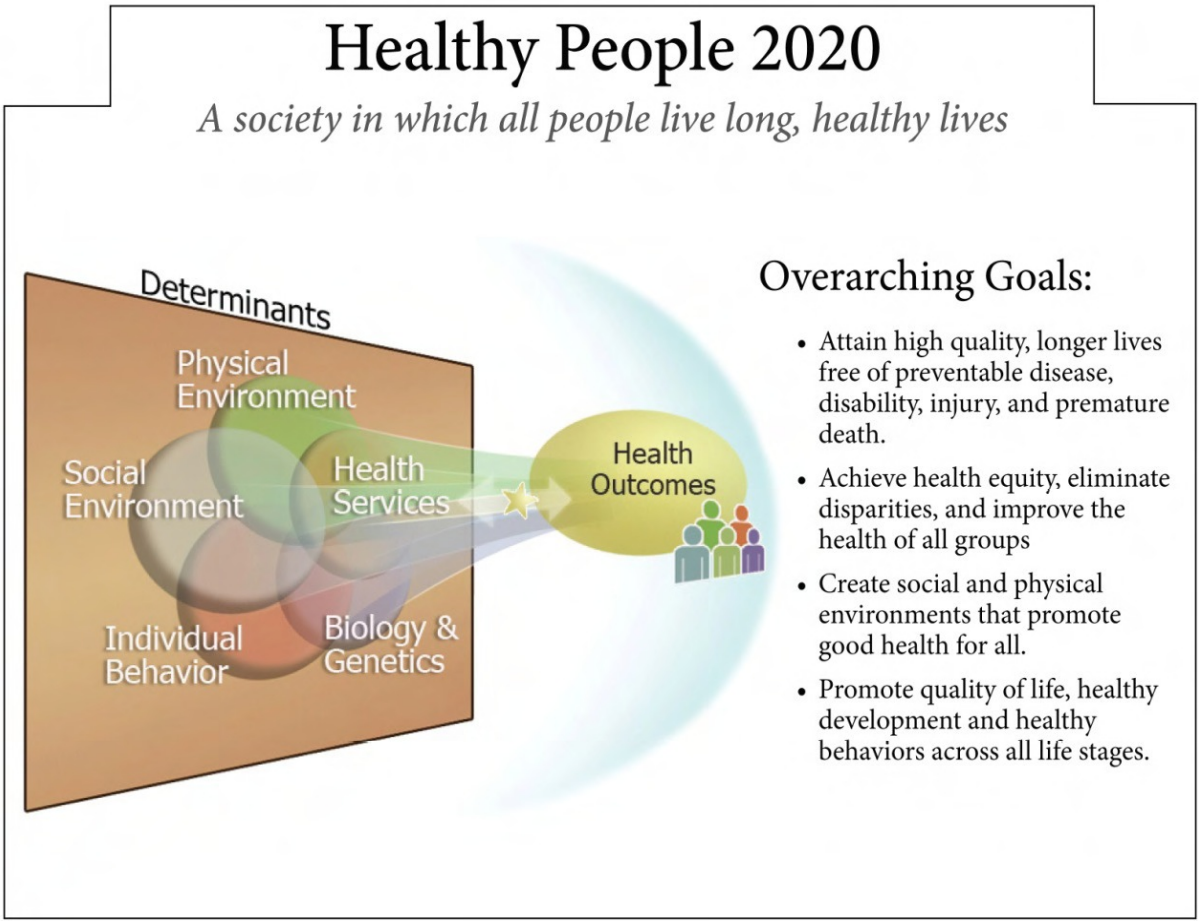
- Identify nationwide health improvement priorities.
- Increase public awareness and understanding of the determinants of health, disease and disability and the opportunities for progress.
- Provide measurable objectives and goals that are applicable at the national, State and local levels.
- Engage multiple sectors to take actions to strengthen policies and improve practices that are driven by the best available evidence and knowledge.
- Identify critical research, evaluation and data collection needs.

Oral Health-One of Ten Leading Health Indicators for Healthy People 2020

Healthy People 2020 has selected a smaller set of objectives, called the *Leading Health Indicators* in an effort to highlight high-priority health issues and actions to be taken to address them. Oral diseases, tooth decay, periodontal disease and oral cancer cause pain and disability for millions of Americans. Unfortunately, the impact of these diseases goes beyond their effects on the mouth and teeth. Research is continuing to provide evidence that links oral health,

particularly periodontal disease, to several chronic diseases such as diabetes, heart disease and stroke. Poor oral health has also been associated with premature births and low birth weight babies (DHHS 2000a).

South Carolina's current progress will set the stage for further improvements engaging our state, communities, professional organizations, agencies and others in moving forward with plans to address the *Healthy People 2020* health objectives. Therefore, the SC State Oral Health Plan will be updated with new benchmarks and targets established for *HP2020*.



IV. The Burden Of Oral Diseases

a. Prevalence of Disease and Unmet Needs

i. Children

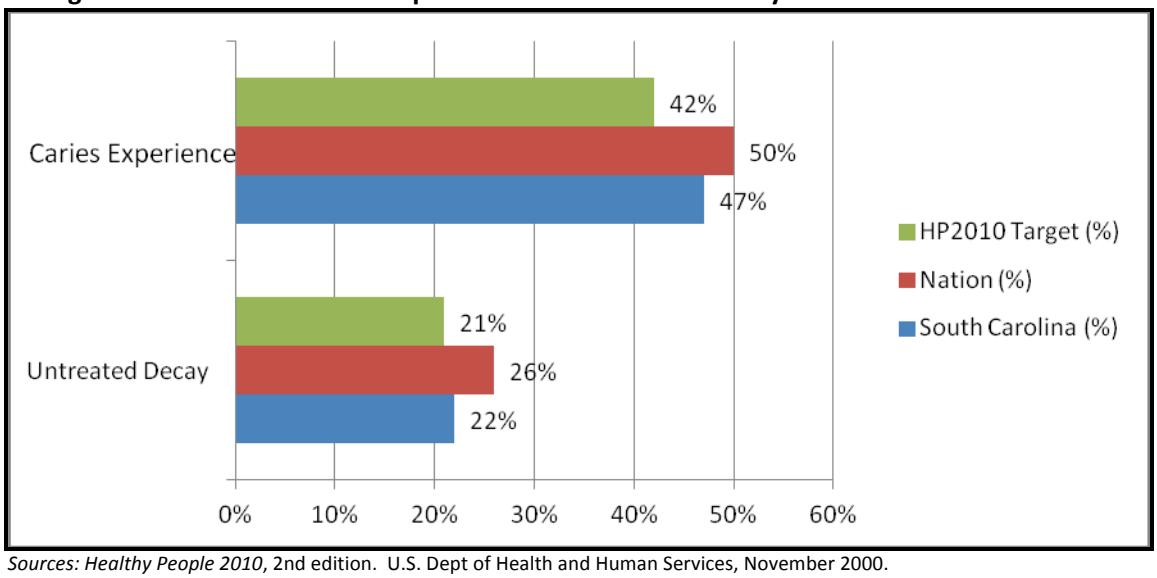
Oral health is an essential and integral component of overall health throughout life. A largely preventable disease, tooth decay disproportionately affects minority, poor and rural children, and is a particularly salient problem in South Carolina (Martin et al. 2010). Approximately 405 of South Carolina's children have experienced tooth decay by kindergarten, with half of them being untreated (SC DHEC 2008). To increase efforts for oral health improvements, *Healthy People 2020* has identified oral health as a leading health indicator.

Dental caries or tooth decay is a disease in which acids produced by bacteria on the teeth lead to loss of minerals from the enamel and dentin, the hard substances of teeth. Unchecked, dental caries can result in loss of tooth structure, inadequate tooth function, unsightly appearance, pain, infection, and tooth loss.

The prevalence of decay in children is measured by assessing caries experience (if they have ever had decay and now have fillings), untreated decay (active unfilled cavities), and urgent care (reported pain or a significant dental infection that requires immediate care).

Caries experience and untreated decay are monitored by South Carolina, consistent with the National Oral Health Surveillance System (NOHSS), which allows comparisons with other states and with the nation. For comparisons between South Carolina, the nation, and the *Healthy People 2010* targets, see Figure 3.

Figure 3 Caries Experience and Untreated Decay in children



Sources: Healthy People 2010, 2nd edition. U.S. Dept of Health and Human Services, November 2000.
South Carolina Needs Assessment, 2007-2008.

Dental caries is not uniformly distributed in the United States or in South Carolina. Some groups are more likely to experience the disease and are less likely to receive treatment. The most recent data for children in South Carolina and the nation, for selected demographic groups, are summarized in Table II.

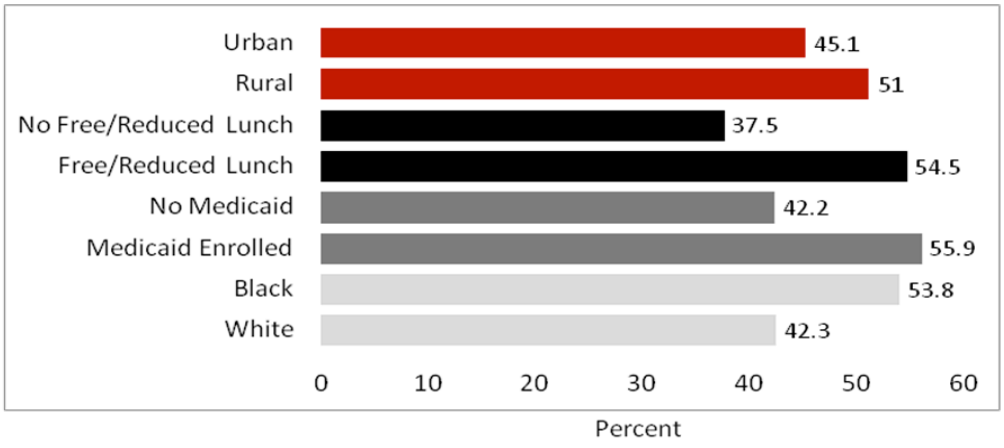
Table II. Dental Caries Experience, Untreated Caries, and Treatment Urgency Among 6- to 8-Year-Old Children and Third Graders in U.S. and South Carolina, by Selected Demographic Characteristics

Category	Caries Experience		Untreated Caries		Treatment Urgency SC (%)	
	US (%)	SC(%)	US(%)	SC(%)	Code 1	Code 2
HP2010 Target						
Total	50	47.1	26	22	15.5	5.9
Race						
White	46	42.4	21	19.6	13.9	4,8
Black	56	53.8	39	25.2	17.8	7
Ethnicity						
Hispanic	69	57	42	27.8	20.6	6.2
Non-Hispanic	49	46	26	22.6	15.4	6.3
Age						
6 to 8 Years	n/a	51.9	n/a	22.8	16.6	5.2
9 to 10 Years	n/a	56.8	n/a	25.3	17.7	6.7
Grade						
Kindergarten	n/a	40.1	n/a	20.4	13.9	6.1
Third	60	55.1	33	23.9	17.2	5.7
Gender						
Male	50	48.2	28	22.6	15.7	6.4
Female	49	46	24	21.8	15.3	5.4

Table II Sources: *Healthy People 2010, database at:* http://wonder.cdc.gov/data2010/focus.htm
South Carolina Needs Assessment 2007-2008

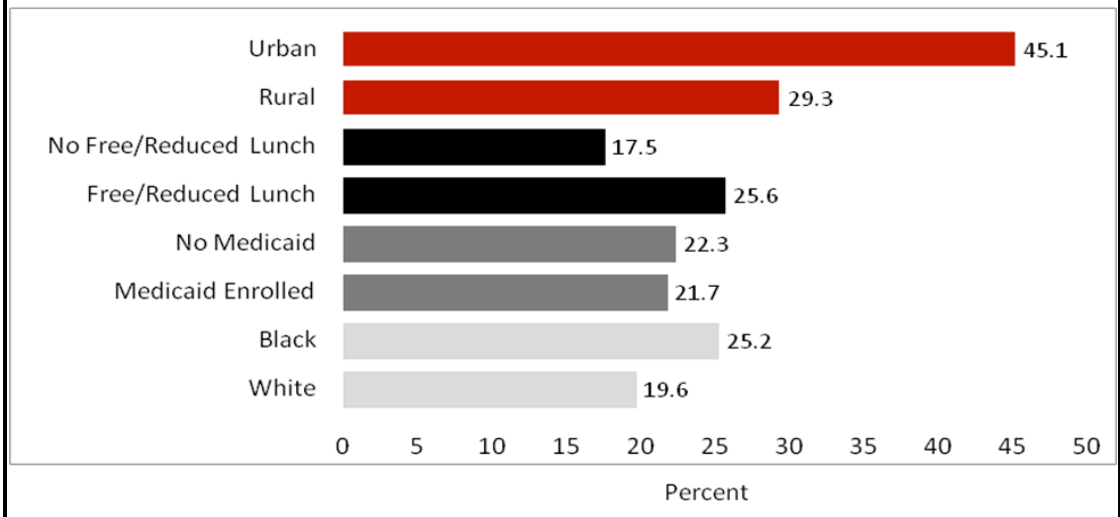
The percentage of children in South Carolina with untreated decay and caries experience by race, location of residence and Medicaid enrollment is shown in Figure 4 and Figure 5. The data from the South Carolina 2008 Oral Health Needs Assessment found that while children enrolled in Medicaid experienced higher rates of tooth decay as compared to children who do not participate in the Medicaid program, they were most connected to care, as demonstrated by greater sealant use and lower untreated decay and treatment urgency.

Figure 4: Percent of Children with Caries Experience, by Select Subgroups



Source: 2008 SC Oral Health Needs Assessment

Figure 5: Percent of Children with Untreated Caries, by Select Subgroups



Source: 2008 SC Oral Health Needs Assessment

ii. Adults

Dental Caries / Tooth Loss / Periodontal (Gum) Diseases / Oral Cancer

People are susceptible to dental caries throughout their lifetime. Like children and adolescents, adults can experience new decay on the crown (enamel covered) portion of the tooth. But adults can also develop caries on the root surfaces of teeth as those surfaces become exposed to bacteria and carbohydrates as a result of gum recession. In the most recent national examination survey, 85 percent of U.S. adults had at least one tooth with decay or a filling on the crown. Root surface caries affects 50 percent of adults aged 75 years or older (USDHHS 2000a).

Not only do adults experience tooth decay, but a substantial proportion of that disease is untreated at any point in time. One-third of adults in United States aged 65 years and over have untreated dental caries. Adults who are minorities, males and have lower levels of education are disproportionally affected by untreated tooth decay. There is no data available at this time to measure the prevalence of untreated dental decay in adults in the state of South Carolina. The National average of 28% for untreated dental decay as we see in Table III is still far from the *HP2010* target of 15%.

Table III. Proportion of Adults in U.S. age 35-44 with Untreated Caries, by Demographic Characteristics

	United States Baseline (1988-94)	United States 2004
HP2010 Target	15	15
U.S. Total	27	28
Race and Ethnicity		
White	24	23
Black or African American	46	40
Hispanic	34	40
Gender		
Male	29	30
Female	25	25
Education		
Less than H. S.	51	50
Graduated H. S.	34	35
Some College	16	18

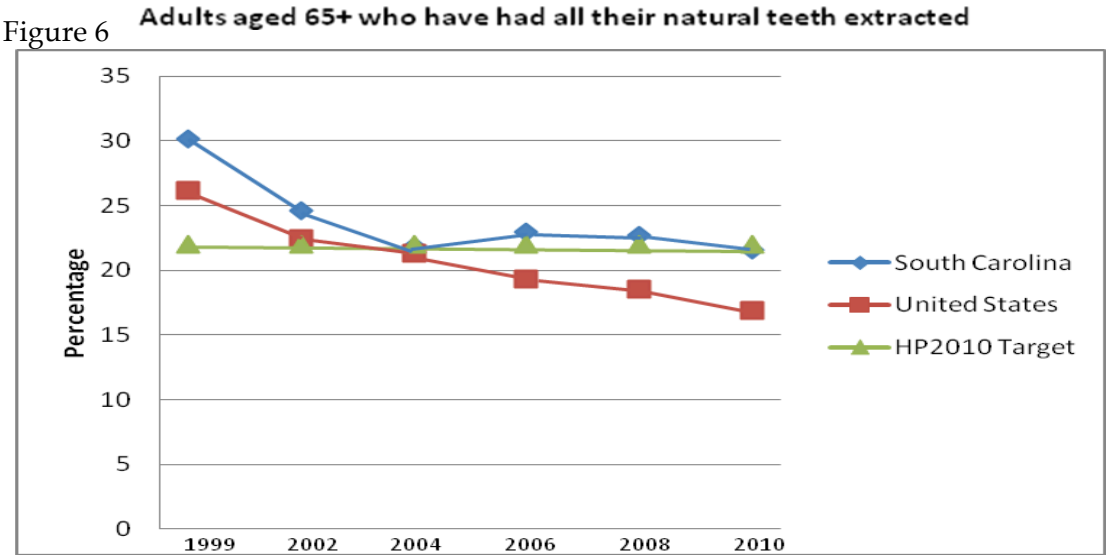
Table III Data Sources: *Healthy People 2010* database, at: http://wonder.cdc.gov/scripts/broker.exe

A full dentition is defined as having 28 natural teeth, exclusive of third molars (the wisdom teeth) and teeth removed for orthodontic treatment or as a result of trauma. Most persons can keep their teeth for life with adequate personal, professional, and population-based preventive practices. As teeth are lost, a person's ability to chew and speak decreases and interference with social functioning can occur. The most common reasons for tooth loss in adults are tooth decay and periodontal (gum) disease. Tooth loss also can result from infection, unintentional injury, and head and neck cancer treatment. In addition, certain orthodontic and prosthetic services sometimes require the removal of teeth.

More older people are keeping their natural teeth than ever before. However, among those aged 65 years and over there are sharp differences by income, with those in poverty twice as likely as those with higher incomes to have lost all their teeth.

The 2010 South Carolina BRFSS data shows that there is a decrease in the proportion of the population age 65-74 who have lost all their natural teeth. In 2010 that proportion reached 21.6% thus meeting the *HP2010* objective of 22%. A comparison of United States, South Carolina and *HP2010* trend data over the past decade are shown in Figure 6, while the trend over the past decade of adults 35-44 years in South Carolina that had no teeth removed is shown in Figure 7. The proportion of adults age 65-74 who had lost all their natural teeth, by selected demographics in South Carolina and the United States are presented in Table IV.

Figure 6



Source: South Carolina BRFSS 2010

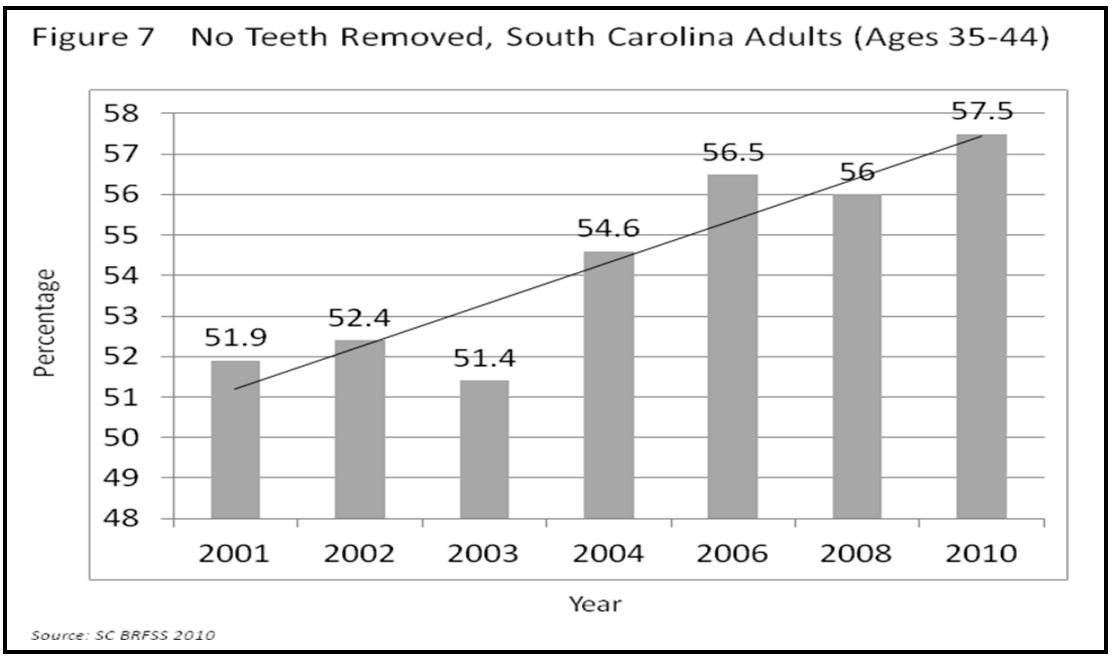


Table IV. Proportion of Adults Aged 65–74 Years Who Have Lost All Natural Teeth, by Selected Demographic Characteristics

	United States[a] (%) BRFSS 2008	South Carolina[b] (%) BRFSS 2010
Healthy People* 2010 Target	22	22
Total	18	21.6
Race/Ethnicity		
White	17	19.4
Black or African American	28.3	24.5
Hispanic	16.2	26.1
Gender		
Male	16.9	20.4
Female	18.9	22.4
Education		
Less than H.S	37.6	48.5
H.S. or G.E.D	22	24.5
Some post H.S	14.1	14
College Graduate	6	5.6
Income		
Less than $15,000	33.5	42.4
$15,000- $24,999	25.4	31.4
$25,000- $34,999	18.4	23.5
$35,000- $49,999	13.4	10.5
$50,000 +	6	5.5

Table IV Sources:

**Healthy People 2010 database* accessed from http://wonder.cdc.gov/scripts/broker.exe

[a]United States BRFSS 2008, (accessed from http://apps.nccd.cdc.gov/nohss/DisplayV.asp?DataSet=2&qkey=8&nkey=9893&Submit1=Go)

[b]South Carolina BRFSS 2010, (accessed from http://www.scdhec.gov/hs/epidata/BRFSS/2010/_alteth2.html)

Gingivitis is characterized by localized inflammation, swelling, and bleeding gums without a loss of the bone that supports the teeth. Gingivitis is usually reversible with good oral hygiene. Daily removal of dental plaque from the teeth is extremely important to prevent gingivitis, which can progress to destructive periodontal disease.

Periodontitis (destructive periodontal disease) is characterized by the loss of the tissue and bone that support the teeth. It places a person at risk of eventual tooth loss unless appropriate treatment is provided. Among adults, periodontitis is a leading cause of bleeding, pain, infection, loose teeth, and tooth loss (Burt & Eklund 1999).

Nationally, the prevalence of gingivitis is highest among American Indians and Alaska Natives, Mexican Americans, and adults with less than a high school education. Although not all cases of gingivitis progress to periodontal disease, all periodontal disease starts as gingivitis. The major method available to prevent destructive periodontitis, therefore, is to prevent the precursor condition of gingivitis and its progression to periodontitis (USDHHS, 2000a).

Periodontal disease is highly prevalent in older adults, affecting 34% of the American population aged >30 years (36 million persons), 40% of Americans 65 years and older and it is severe in 13% of adults. Severe periodontal disease often results in tooth loss, which can diminish quality of life, and is related to poorer general health in adults. Periodontal disease in adults has decreased since the early 1970s. However, older adults, Black and Hispanic adults, current smokers, and those with lower incomes and less education are more likely to have moderate and severe periodontal disease. Recent studies suggest that periodontal disease has important systemic implications that can influence the risk for certain systemic diseases, such as cardiovascular diseases, diabetes, and reproductive outcomes. There is currently no data available on the prevalence of gingivitis and of periodontitis in South Carolina. This data may be available in the future through linked Medicaid and Medicare data sets. The prevalence of gingivitis and periodontitis in United States among adults 35-44 years by selected demographic characteristics is shown in Table V. There is still work to be done in order to meet the *HP2010* objectives. Success relies on behavioral changes at the individual level; policy changes at the state level; and system changes at the state and national levels.

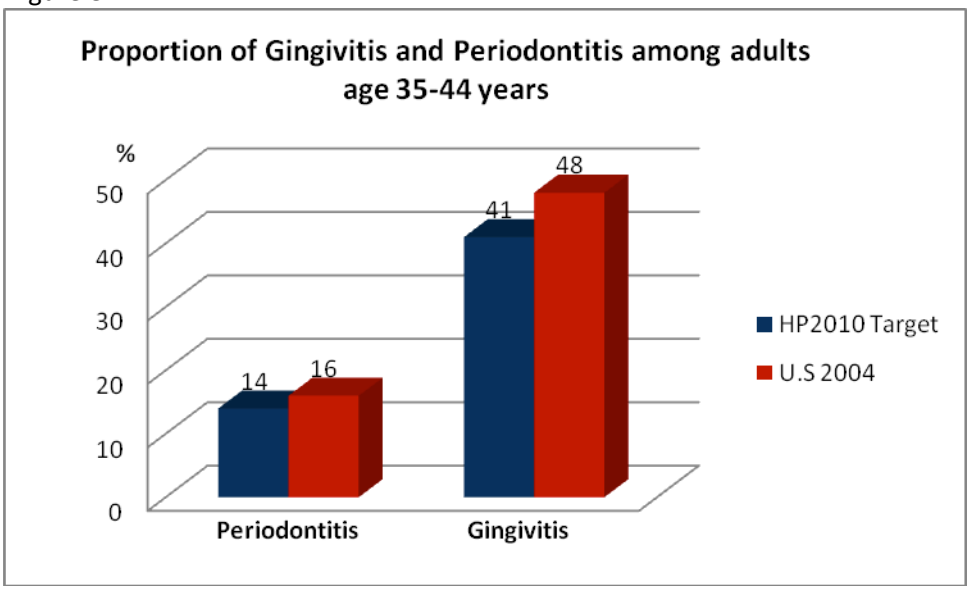
Table V. Proportion of Adults aged 35–44 Years with Gingivitis or Adults Aged 35–44 Years with Destructive Periodontal Disease, by Selected Demographic Characteristics

	Gingivitis (%) (1988-94)	Periodontitis (%) (2004)
Healthy People* 2010 Target	41	14
U.S Total	48	16
Race/Ethnicity		
White	45	14
Black or African American	51	23
Hispanic	64	16
American Indian or Alaska Native	96	59
Gender		
Male	52	20
Female	45	12
Education		
Less than H.S	60	34
Some post H.S	52	18
College Graduate	42	11

Table V Sources:
Healthy People 2010 database available at http://wonder.cdc.gov/scripts/broker.exe

The comparison of proportions of adult gingivitis and periodontitis in the United States with *HP2010* target is shown in Figure 8.

Figure 8



Source:
Healthy People 2010 database available at http://wonder.cdc.gov/scripts/broker.exe

Cancer of the oral cavity or pharynx (oral cancer) is the fourth most common cancer in African American men and the seventh most common cancer in White men in the United States (Ries et al. 2004). It was estimated that 40,250 men and women will be diagnosed and 7,850 will die from oral cancer in 2012 (National Cancer Institute, SEER Stats Fact Sheet, 2012). The 2009 age-adjusted incidence rate of oral cancer in the United States was 10.9 per 100,000 persons. Over 90 percent of cases of oral cancer in the United States occur among persons aged 45 years and older. The age-adjusted incidence was more than twice as high among men (16.1 per 100,000) than among women (6.2 per 100,000) (United States Cancer Statistics, 1999-2009 Incidence, WONDER On-line Database). The 2009 age-adjusted mortality rate was more than twice as high among men (3.8 per 100,000) than among women (1.4 per 100,000) (United States Cancer Statistics: 1999 - 2009 Mortality, WONDER On-line Database).

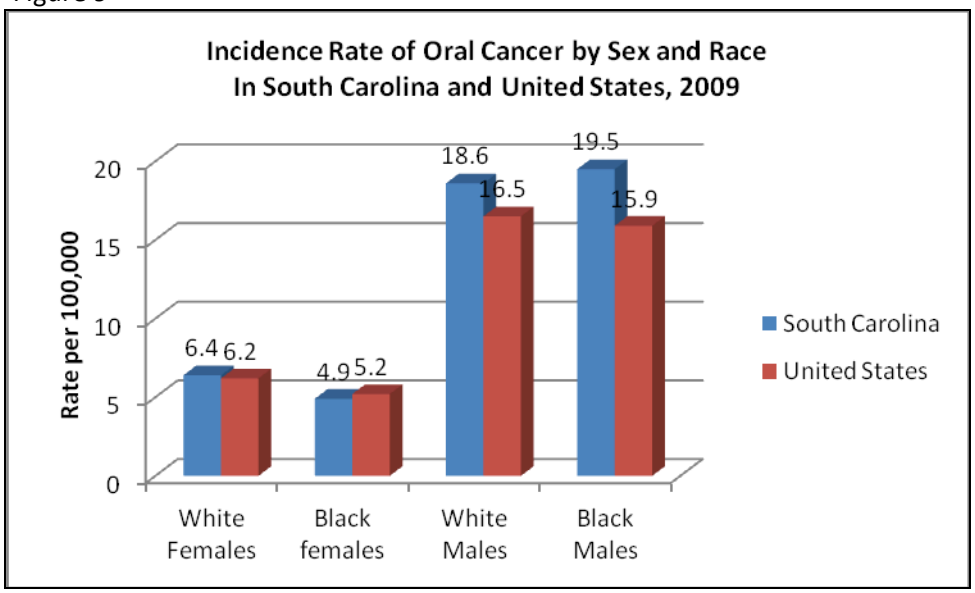
Survival rates for oral cancer have not improved substantially over the past 25 years. More than 40% of persons diagnosed with oral cancer die within five years of diagnosis (Ries et al. 2004), although survival varies widely by stage of disease when diagnosed. The 5-year relative survival rate for persons with oral cancer diagnosed at a localized stage is 81%. In contrast, the 5-year survival rate is only 51% once the cancer has spread to regional lymph nodes at the time of diagnosis and is just 29% for persons with distant metastasis.

Recent studies have shown that 60% of all oro-pharyngeal cancers (the back of the throat including the base of the tongue and tonsils) are linked to Human Papilloma Virus (HPV). According to the Centers for Disease Control and Prevention (CDC), almost 2,370 new cases of HPV associated oro-pharyngeal cancer are diagnosed each year in women and 9,356 in men (*HPV-Associated Cancers)*.

Some groups experience a disproportionate burden of oral cancer. In South Carolina and nationally, Blacks are more likely than Whites to develop oral cancer and much more likely to die from it. Cigarette smoking and alcohol are the major known risk factors for oral cancer.

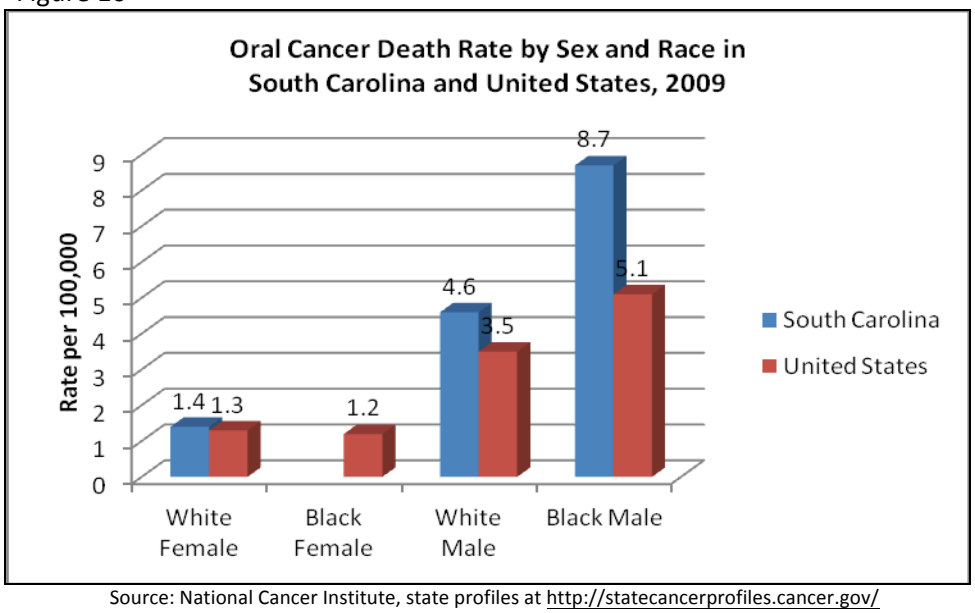
In South Carolina, the incidence of oral cancer among White women and Black women is about 6.4 and 4.9 per 100,000 population respectively. South Carolina White men have an incidence rate of 18.6 per 100,000 and South Carolina Black men get oral cancer at a rate of 19.5 per 100,000 population. The oral cancer death rates show a similar racial stratification: White women have a death rate of 1.4 per 100,000 population; the rate among Black women is not calculated because the number of deaths is fewer than 15 and rates calculated from counts less than 15 tend to be unstable; the rate among White men is 4.6 per 100,000; and the rate among Black men is 8.7 per 100,000 (National Cancer Institute, 2009 data). This data is shown in Figure 9 and Figure 10.

Figure 9



Source: National Cancer Institute, state profiles at http://statecancerprofiles.cancer.gov/

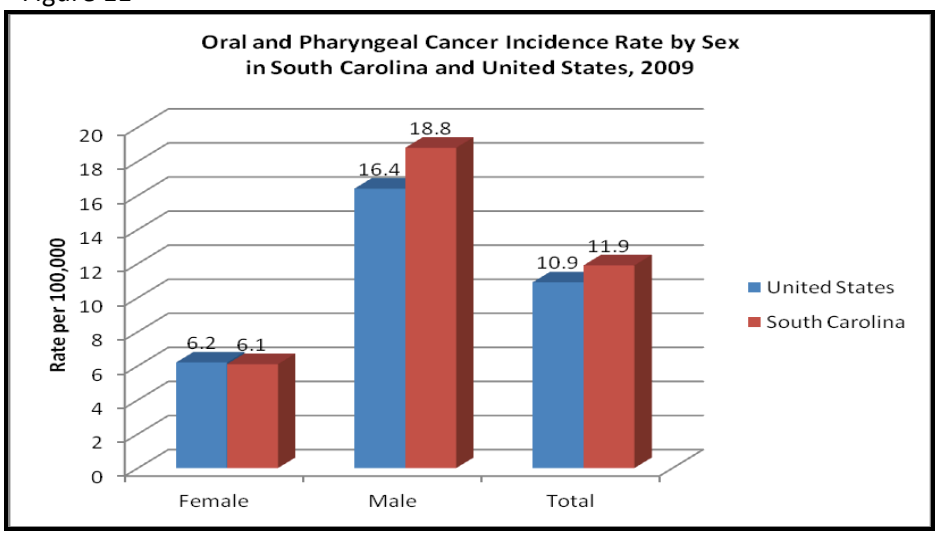
Figure 10



Source: National Cancer Institute, state profiles at http://statecancerprofiles.cancer.gov/

A comparison of oral cancer incidence rates between South Carolina and United States is shown in Figure 11. South Carolina has a higher incidence rate of oral cancer compared to United States respectively 11.9 and 10.9, respectively. While the incidence rate for women is similar to the United States, the incidence rate for men is higher, 18.8 compared to 16.4 the incidence rate in the United States.

Figure 11



Source: National Cancer Institute, state profiles at http://statecancerprofiles.cancer.gov/

Available evidence indicates that oral cancer diagnosed at an early stage has a better prognosis. Several *Healthy People 2010* objectives specifically address early detection of oral cancer: Objective 21-6 is to "Increase the proportion of oral and pharyngeal cancers detected at the earliest stage," and Objective 21-7 is to "Increase the proportion of adults who, in the past 12 months, report having had an examination to detect oral and pharyngeal cancer" (USDHHS 2000b). Data for United States progress on the proportion of oral cancer cases detected at the earliest stage (stage I, localized) are presented in Table VI.

Table VI. Proportion of Oral Cancer Cases Detected at the Earliest Stage, by Selected Demographic Characteristics

	Baseline (%) (1988-94)	United States (%) (2004)	United States (%) (2006)
Healthy People 2010 Target	51	51	51
U.S Total	36	35	33
Race/Ethnicity			
White	39	38	34
Black or African American	22	22	25
Hispanic	33	34	33
American Indian or Alaska Native	26	28	25
Gender			
Male	34	33	28
Female	40	41	42

Table VI Sources:
Healthy People 2010 database, at: http://wonder.cdc.gov/data2010/focus.htm

Data for United States progress on the proportion of annual examinations for oral and pharyngeal cancer in adults aged 40 years and over are presented in Table VII.

Table VII. Proportion of Annual Examinations for Oral and Pharyngeal Cancers in Adults 40 years and over, by Demographic Characteristics

	United States (%) Baseline (1988-94)	United States (%) (2008)
Healthy People 2010 Target	20	20
U.S Total	13	18
Race/Ethnicity		
White	14	20
Black or African American	7	8
Hispanic	6	7
American Indian or Alaska Native	13	DSU
Gender		
Male	12	17
Female	14	20
Education		
Less than H.S	5	4
Some post H.S	10	13
College Graduate	19	25

Table VII Sources:
Healthy People 2010 database, at: http://wonder.cdc.gov/data2010/focus.htm
DSU: Data does not meet the criteria for statistical reliability, data quality, or confidentiality

b. Disparities

Healthy People 2010 calls for the elimination of disparities in access to health care and health outcomes and increasing the quality of life. These goals are reflected in the SC DHEC's Strategic Plan, and also in the SOHP enacted by the DOH. Oral health is a significant contributor to overall health; to increase quality of life, South Carolina must improve the oral health of its citizens.

Determinants of Oral Health

Determinants of health are factors that combined together affect the health of individuals and communities. Whether people are healthy or not, is determined by their circumstances and environment. To a large extent, factors such as where we live, the state of our environment, genetics, our income and education level, and our relationships with friends and family all have considerable impacts on health. Social factors, including: education, employment status, income level, gender and ethnicity also have a marked influence on a person's health outcomes.

In order to address Oral Health inequities in South Carolina, first we must understand the complexity of dental disease and its impact/ burden on our society. According to Robinson, Shore, Brookes, Strafford, Wood and Kirkham (2000), "Dental caries is the most ambiguous

disease of mankind associated with tooth loss, pain and distress" (p. 481). It is a communicable infectious disease, progressive and destructive (Wilkins, 2005, p. 393), that could have fatal consequences if not treated. According to the Institute of Medicine Report (IOM 2011), there is an association between individual and societal morbidity and untreated dental caries (p. 2-3). Due to lack of adequate surveillance, registry, confidentiality issues and inconsistent diagnostic coding, it would be difficult to estimate the number of deaths related to dental disease (Casamassimo, Thikkurissy, Edelstein & Maiorini, 2009, p. 652).

Oral Health Inequities

According to World Health Organization (WHO), health inequities are systematic differences in the health status or in the distribution of health of health resources between different population groups, arising from the social conditions in which people are born, grow, live, work and age.

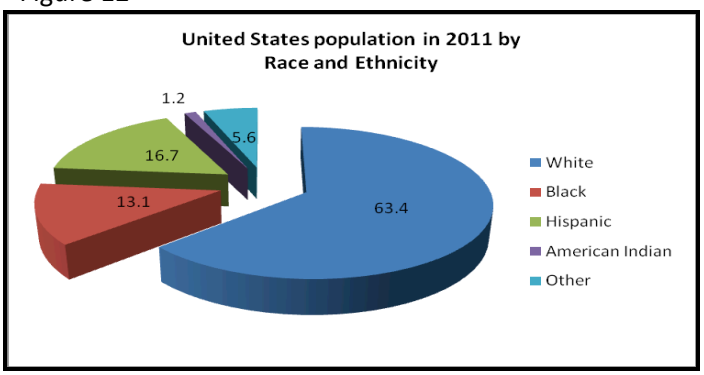
i. Racial and Ethnic Groups

Although gains in oral health status have been achieved for the population as a whole, they have not been evenly distributed across subpopulations. Non-Hispanic Blacks, Hispanics, American Indians and Alaska Natives generally have the poorest oral health of any of the racial and ethnic groups in the U.S. population. As reported above, these groups tend to be more likely than non-Hispanic Whites to experience dental caries, have more extensive tooth loss and are less likely to have received treatment. Black adults in each age group are more likely than other racial/ethnic groups to have gum disease. Compared with White Americans, Blacks are more likely to develop oral or pharyngeal cancer. They are less likely to have it diagnosed at early stages, and experience a worse 5-year survival rate.

Overall, 24% of SC's population lives in poverty (Kaiser 2010-2011). People residing in poor families are less likely to receive both preventive and treatment dental services (Manski and Brown, 2007; Stanton and Rutherford, 2003). Hispanics represent only 5.3% of the state's population; however, account for 36% of the individuals living in poverty. A Black-White disparity for all persons living in poverty is also present. While 64% of the state's population is White and 28% is Black, only 17% of Whites live in poverty as compared to 38% of Blacks. (Kaiser 2010-11).

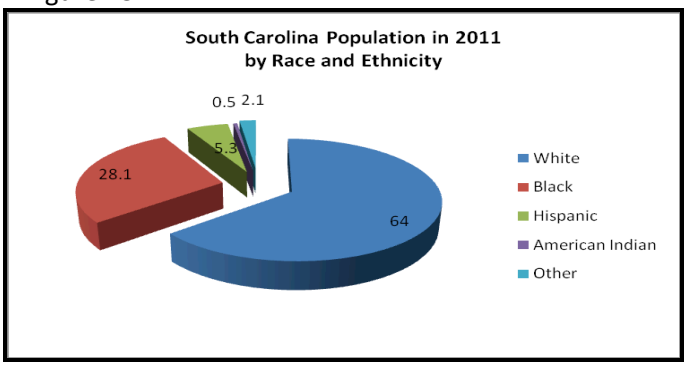
A quick view of the population distribution in the United States by race and ethnicity is shown in Figure 12, while the population distribution in South Carolina is shown in Figure 13.

Figure 12



Source: United States Census Bureau at
http://quickfacts.census.gov/qfd/states/45000.html

Figure 13



Source: United States Census Bureau at
http://quickfacts.census.gov/qfd/states/45000.html

School Aged Children demographics

In 2010, there were 922,130 children between the ages of five and 19 (SC SCAN), comprising 20% of the population of South Carolina. Of these children, 63% are White, 35% Black and 3% other racial categories (Table VIII).

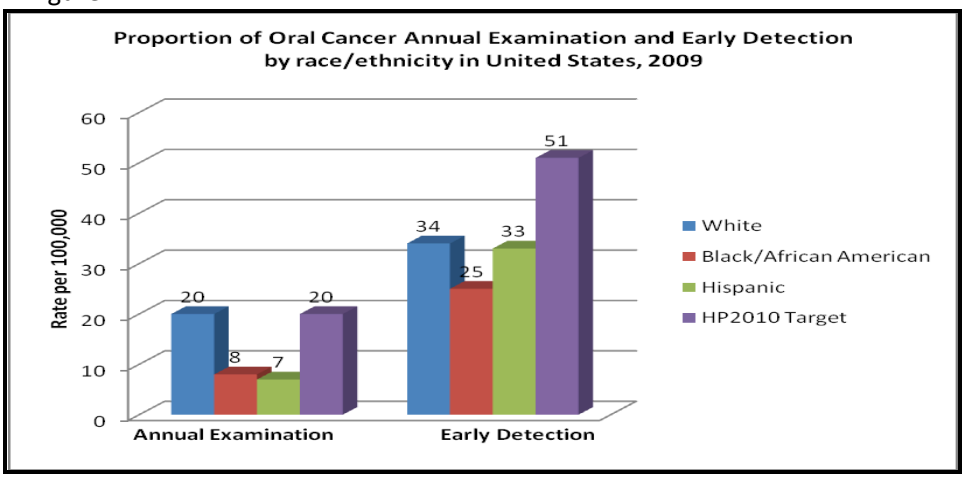
Table VIII: Population Statistics for South Carolina School Age Children
Year 2010

	Age 5 - 9	Age 10 - 14	Age 15 - 17	Age 18 - 19	Selection Total	% of Total SC Population
Race	**Number**	**Number**	**Number**	**Number**	**Number**	**Number**
White	189,540	189,720	123,300	82,200	584,760	12.64%
Black	98,810	101,000	69,890	46,590	316,290	6.84%
Other	7,500	6,570	4,200	2,800	21,080	0.46%
All Races	295,850	297,290	197,390	131,600	922,130	19.94%

Source: SC SCAN 2010

Black and Hispanic populations have lower rates of annual examination of oral cancer (8 per 100,000 and 7 per 100,000 respectively) compared to Whites (20 per 100,000), thrusting both minority populations to fall behind in meeting the *HP2010* objective of 20 per 100,000. Similar conclusions were drawn for the early detection of oral cancer. Black and Hispanic populations have lower rates for early detection of oral cancer, 25 and 33 per 100,000 respectively (Figure 14), when compared to Whites (34 per 100,000), thus all races falling behind in meeting the *HP2010* objective (51 per 100,000).

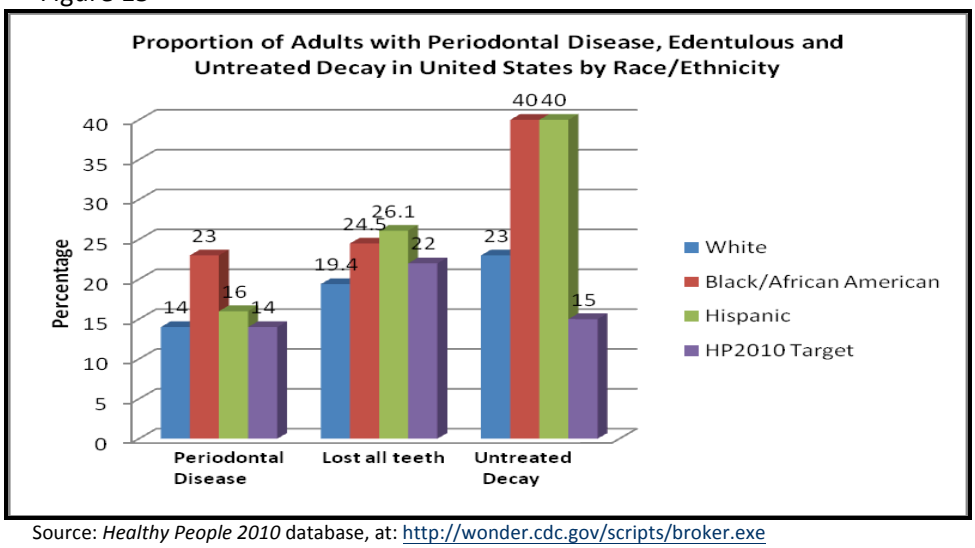
Figure 14



Source: National Cancer Institute, state profiles at http://statecancerprofiles.cancer.gov/

Similar observations are seen in the proportion of adults in the United States with periodontal disease, untreated decay and those that have lost all their natural teeth. The proportion of Black and Hispanic population again is higher than the proportion of Whites, falling short from *HP2010* target goal. The most noticeable difference between these populations and *HP2010* is in the untreated caries category. Actually the proportion of Whites that had all their natural teeth removed is 19.4%, thus surpassing the *HP2010* objective of 22% and the proportion of Whites that have periodontitis is the same as the *HP2010* target goal of 14%. See Figure 15.

Figure 15

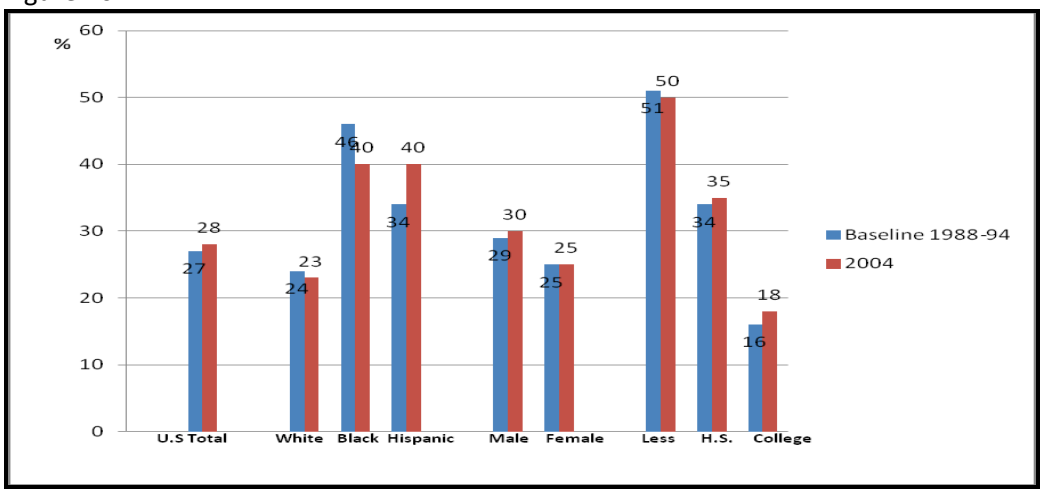


Source: *Healthy People 2010* database, at: http://wonder.cdc.gov/scripts/broker.exe

Untreated dental caries among adults 35-44 years of age by gender, race/ethnicity and education level in the United States is shown in Figure 16.

Proportion of Adults in United States, age 35-44 with Untreated Dental Caries, by Demographic Characteristics

Figure 16



Source: *Healthy People 2010* database, at: http://wonder.cdc.gov/scripts/broker.exe

ii. Women's Health

Most oral diseases and conditions are complex and are the product of interactions between genetic, socioeconomic, behavioral, environmental, and general health influences. Multiple factors may act synergistically to place some women at higher risk of oral diseases. For example, the comparative longevity of women, compromised physical status over time, and the combined effects of multiple chronic conditions and side effects from multiple medications used to treat them can result in increased risk of oral disease (Redford 1993).

Many women live in poverty, are not insured, and are the sole head of their household. For these women, obtaining needed oral health care may be difficult. In addition, gender-role expectations of women may affect their interaction with dental care providers and could affect treatment recommendations as well.

Many, but not all, statistical indicators show women to have better oral health status than do men (Redford 1993; USDHHS 2000a). Women are less likely than men at each age group to have severe periodontal disease. Both Black and White women have a substantially lower incidence rate of oral and pharyngeal cancers than do Black and White men, respectively. However, a higher proportion of women than men have oral-facial pain, including pain from oral sores, jaw joints, face/cheek, and burning mouth syndrome. In South Carolina women visit their dentist and have more frequent cleanings. A comparison between females and males that visited the dentist in the past year is shown in Figure 17, while the comparison of females and males that have had their teeth cleaned in the past year is shown in Figure 18. Both White and Black women have a higher percentage than men in both categories.

Figure 17

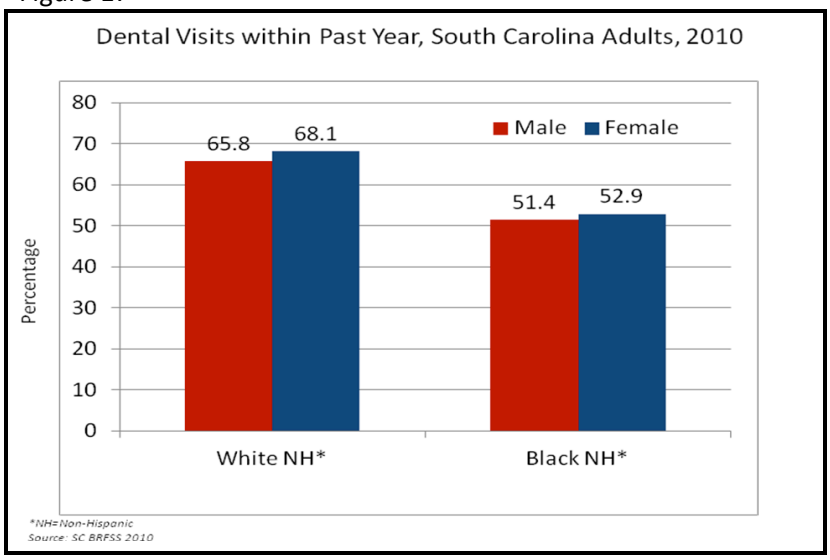
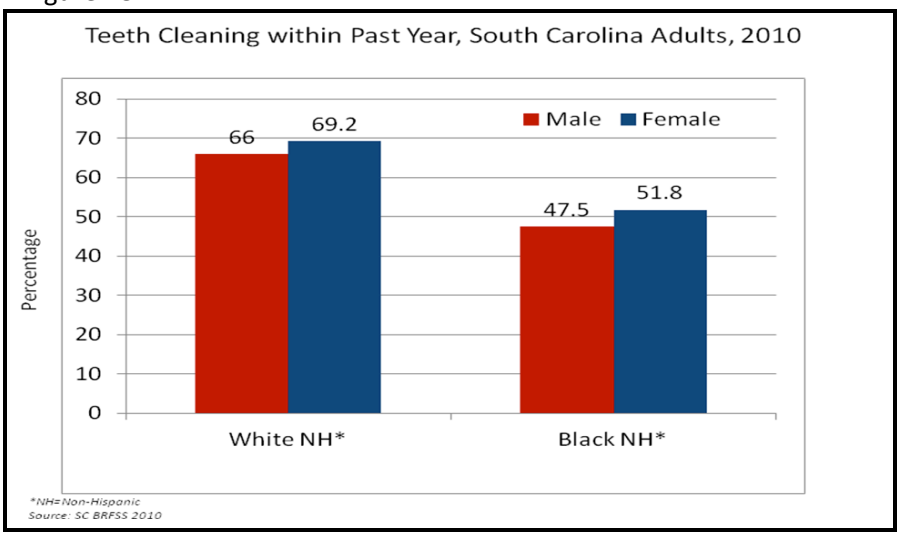
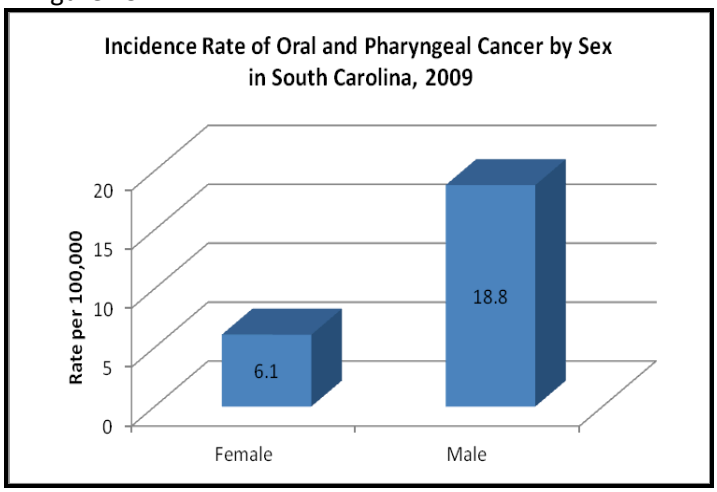


Figure 18



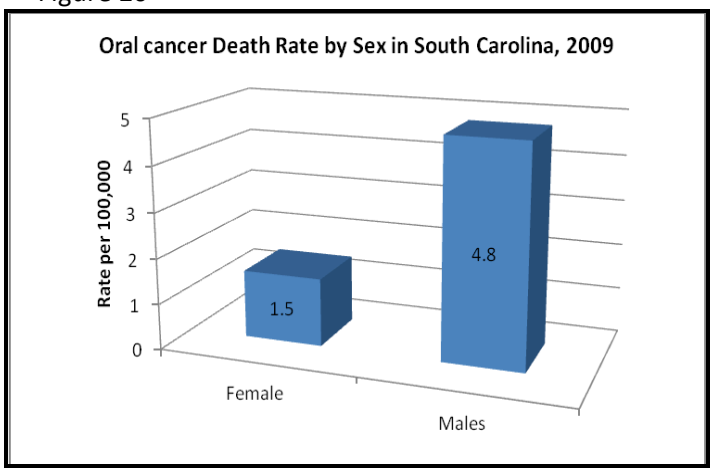
In South Carolina, women also have a lower incidence rate and death rate from oral cancer compared to men Figure 19 and Figure 20.

Figure 19



Source: National Cancer Institute, state profiles at http://statecancerprofiles.cancer.gov/

Figure 20



Source: National Cancer Institute, state profiles at http://statecancerprofiles.cancer.gov/

iii. People with Disabilities

The oral health problems of individuals with disabilities are complex. These problems may be due to underlying congenital anomalies, as well as to an inability to receive the personal and professional health care needed to maintain oral health. More than 54 million persons are defined as disabled under the Americans with Disabilities Act, including almost 1 million children under 6 years of age and 4.5 million children between 6 and 16 years of age.

No national or state level studies have been conducted to determine the prevalence of oral and craniofacial diseases among the various populations with disabilities. Several smaller-scale

studies show that the population with intellectual disability or other develop-mental disabilities has significantly higher rates of poor oral hygiene and needs for periodontal disease treatment than the general population. This is due in part to limitations in individual understanding of and physical ability to perform personal prevention practices or to obtain needed services. Caries rates among people with disabilities vary widely, but overall their caries rates are higher than those of people without disabilities (USDHHS 2000a).

iv. Socioeconomic Disparities

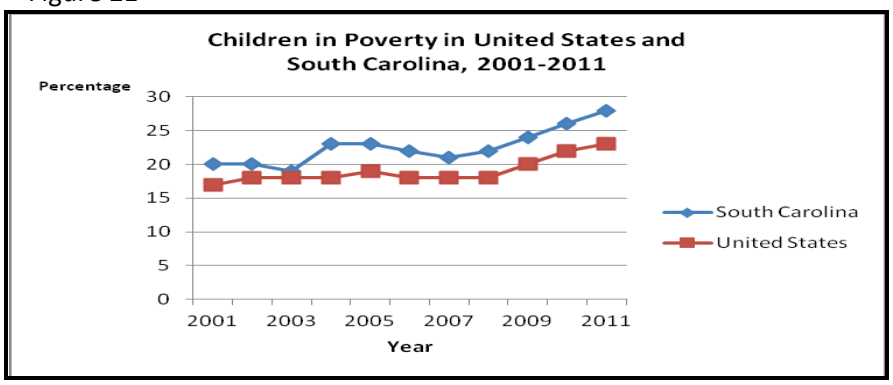
People living in low-income families bear a disproportionate burden from oral diseases and conditions. For example, despite progress in reducing dental caries in the United States, children and adolescents in families living below the poverty level experience more dental decay than do children who are economically better off. Furthermore, the caries seen in individuals of all ages from poor families is more likely to be untreated than caries in those living above the poverty level. The pattern is similar in adults, with the proportion of untreated decayed teeth being higher among the poor than the non-poor. At every age, a higher proportion of those at the lowest income level than at the higher income levels have periodontitis. Overall, a higher percentage of Americans living below the poverty level are edentulous (have lost all their natural teeth) than are those living above poverty (USDHHS 2000a). People living in rural areas also have a higher disease burden because of difficulties in accessing preventive and treatment services.

Poverty in South Carolina

- *Children*

Nationally and in South Carolina, the percentage of children under the age of 18 years living below the federal poverty level has increased from 2001 to 2011 (Figure 14). In 2011, 28% of SC's children are living in poverty. Of these children, 42% of the state's Black children meet the definition of living in low-income families, although Blacks account for only 32% of the state's population. White children account for 55% of the state's population, but only 15% of the children living in poverty (Kids Count, 2010). Children living in low-income families are at a disproportionately high risk for oral disease and untreated tooth decay. The racial disparity among children living in poverty contributes to the racial disparity seen in the oral health of South Carolina's children. Increasing trend of children in poverty is shown in Figure 21.

Figure 21



Source: Kids Count 2011

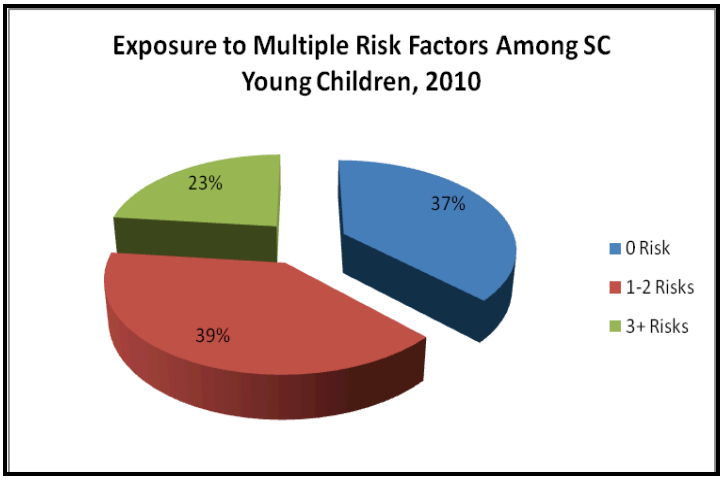
- *Young Children*

The health and well-being of South Carolina's infants and young children will shape the future of South Carolina. All babies and young children need good health, strong families and positive early learning experiences to foster healthy brain development and realize their potential.

Many of our infants and young children are growing up in families that can adversely affect their health, performance in school and development. Children need adequate health care, food, housing and early learning opportunities. Examples of the risk factors that may jeopardize South Carolina's children include: living in single-parent homes, living in poverty, unemployed parents, and parents with less than a high school education. Sixty two percent of SC's young children have at least one risk factor known that increases their chance of poor health, school and developmental outcomes.

Nationally, more than one in five children lived in poverty in 2010 (ACS 2010). Currently in South Carolina, 53% of young children live in low income families. Among low income children in SC, 14% live in extreme poverty (< 50% FPL) (NCCP 2010). In 2009, 13% of children 0-18 years of age in SC do not have insurance as compared to 10% nationally (www.nccp.org 2010). Children living in low-income families are at a higher risk for oral disease and untreated tooth decay. The racial disparity among children living in poverty contributes to the racial disparity seen in the oral health of South Carolina's children. According to National Center for children in Poverty, in 2010, 39% of young children had exposure to 1-2 risk factors, while 23% had exposure to multiple risk factors for tooth decay and oral diseases (Figure 22).

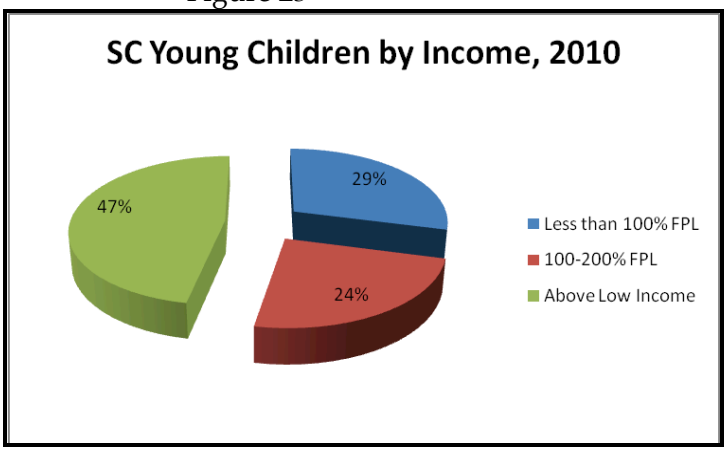
Figure 22



Source: National Center for Children in Poverty, 2010
Available at: http://www.nccp.org/profiles/SC_profile_16.html

Also, according to the National Center for Children in Poverty (NCCP), 29% of young children fall in less than 100% FPL (Federal Poverty Level), while 24% fall in 100-200 FPL (Figure 23).

Figure 23



Source: National Center for Children in Poverty, 2010
Available at: http://www.nccp.org/profiles/SC_profile_16.html

- *Older Adults*

Nationally, one in ten adults age 65 and older live in family with an income below the federal poverty level. One in six are considered poor, which means their income is below 125 % of the FPL and one-third fall into the low-income bracket (less than 200 % FPL) (AARP 2012). Poverty disproportionately affects older adults who are Black, Hispanic, those with limited

education and those who are not married. In 2010, The Administration on Aging reported that persons age 65 and over accounted for 13.7 % of the population in SC, a 30.4% increase since 2000 (2011). In 2010-11, Kaiser State Facts reported that 14% of South Carolina older adults are living in poverty.

Where does South Carolina stand?

According to Kaiser Foundation, South Carolina lags behind the National level. South Carolina has 41% poverty rate up to 200% FPL compared to the National average of 39%. Also, South Carolina has a rate 13% of un-insured children 0-18; a rate of 18% un-insured low-income children and a rate of 20% un-insured poor children compared to the National average of 10%; 16% and 17% respectively. Other indices such as: median household income; dental expenditures per capita; unemployment rates; and Medicaid coverage for low income and poor children, places South Carolina behind the national average rates. Collectively, these characteristics make South Carolina one of the poorest states in the country. Table IX gives a detailed comparison between South Carolina and the United States.

Table IX: Detailed Comparison between South Carolina and the United States

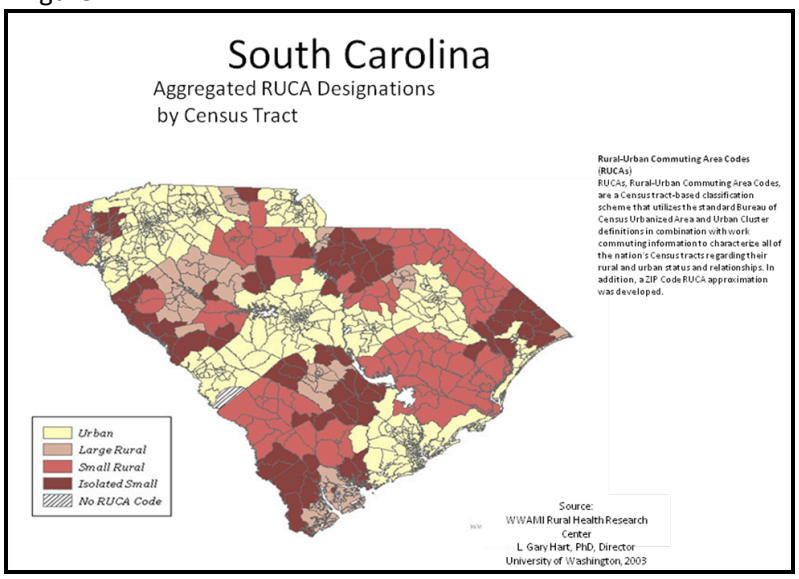
	South Carolina	U.S.
Population in 2009	4,482,700	303,343,3000
Children under 18 years of age (2009)	26%	26%
Population poverty rate up to 200 % FPL in 2009	41%	39%
Poverty rate up to 100% FPL in 2009 by age under 18	26%	27%
Median household income in 2007-2009	$42,945	$49,945
Unemployment rate for 2010-2011	11%-11.1%	9.6%-9.1%
One or more Oral Health problems in children 1-17 of age in 2007	25.3%	26.7%
HC dental expenditure by state of residency per capita in 2004	$239	$277
Medicaid Insurance coverage for 0-18 years of age in 2009	27%	33%
Un-insured children 0-18 of age in 2009	13%	10%
2009 Medicaid coverage for poor children, up to 100% FPL	67%	68%
Un-insured poor children with poverty rate up to 100% FPL	20%	17%
Low income children (up to 200% FPL) on Medicaid in 2009	51%	59%
Un-insured low income children (up to 200%FPL) in 2009	18%	16%
Active physicians per 10,000 population	22.4	27.7

Source: Kaiserhealthfacts.org

Rural vs. Urban South Carolina

The South Carolina ORS defines a county as "urban" if its largest city has a population greater than 25,000. A county is defined as "rural" if the population of the largest city is between 10,000 and 25,000, and as "very rural" if the largest city has a population of less than 10,000. According to United States Census Bureau in 2010, almost 66.33% of the population lives in urban areas, while 33.67% live in rural areas. Of the 46 counties in South Carolina, only 15 meet the definition of being an urban county. A map of the rural and urban areas in South Carolina is shown in Figure 24.

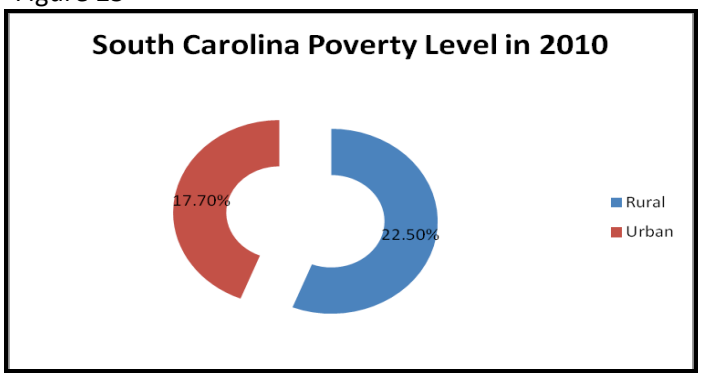
Figure 24



According to the United States Census Bureau in 2010, almost 33.67% of South Carolina's population lives in rural areas. Residents of rural counties are placed at a higher risk of having poor oral health outcomes for multiple reasons. Residents are likely to be of lower socioeconomic status than those living in more urban areas, which can make it very difficult to access care. Residents of rural counties are also more likely to be less educated, elderly and have limited access to a dentist.

In 2010 the poverty level of total population in South Carolina was 18.8% and the poverty level for children was 27.5% (USDA, 2010) see Figure 25. To further compound the impact of higher poverty rates in rural communities, there are other barriers to dental care which include fewer dentists per population; fewer dentists who participate in the Medicaid program; and longer travel times and distances to reach health care providers compared to urban areas. The combined effect of dental workforce issues and extensive travel times result in reduced access to dental services in rural communities (Martin et al. 2012).

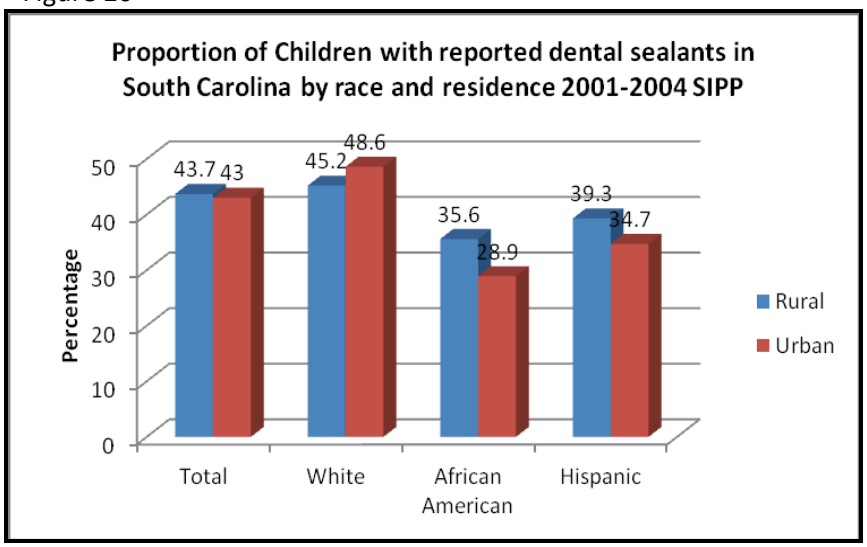
Figure 25



Source: USDA accessed at:
http://www.ers.usda.gov/data-products/atlas-of-rural-and-small-town-america.aspx

According to the South Carolina Rural Health Research Center (SCRHRC) report issued in March 2013, there is no difference between children in rural (43.7%) and urban (43%) areas when it comes to utilization of dental sealants. Black children are more likely to have less sealants than Whites and Hispanic children, both in Rural and Urban areas in South Carolina (Figure 26).

Figure 26



Source: SCRHRC at http://rhr.sph.sc.edu/report/(9-2)Fact%20Sheet%20Dental%20Sealants.pdf

c. Societal Impact of Oral Disease

i. Social and Economic Impact

Oral health is related to well-being and quality of life as measured along functional, psychosocial, and economic dimensions. Diet, nutrition, sleep, psychological status, social interaction, school, and work are affected by impaired oral and craniofacial health. Oral and craniofacial diseases and conditions contribute to compromised ability to bite, chew, and

swallow foods. This leads to limitations in food selection and poor nutrition. These conditions include tooth loss, diminished salivary functions, oral-facial pain conditions such as temporo-mandibular disorders, alterations in taste, and functional limitations of prosthetic replacements. Oral-facial pain can be a symptom of untreated dental and oral problems or can be a condition in and of itself. Ultimately it is a major source of a diminished quality of life and is associated with sleep deprivation, depression, and multiple adverse psychosocial outcomes.

More than any other body part, the face bears the stamp of individual identity. Attractiveness has an important effect on psychological development and social relationships. Considering the importance of the mouth and teeth in verbal and nonverbal communication, diseases that disrupt their functions are likely to damage self-image and alter the ability to sustain and build social relationships. The social functions of individuals encompass a variety of roles, from intimate interpersonal contacts to participation in social or community activities, including employment. Dental diseases and disorders can interfere with these social roles at any or all levels. Perhaps due to social embarrassment or functional problems, people with oral conditions may avoid conversation or laughing, smiling, or other nonverbal expressions that show their mouth and teeth.

Direct Costs of Oral Diseases / Indirect Costs of Oral Diseases

Untreated dental conditions could have a major impact on national health expenditures and become an economic burden for all American taxpayers (American Academy of Pediatric Dentistry, 2009, p.102). According to The PEW Center on the States (2010), the annual spending for dental services in the United States is expected to increase 58% between the years 2009-2018 (p. 2). As costs increase from $101.9 billion to $161.4 billion, only one-third (approximately) of the money spent on dental services goes to services for children (PEW, 2010 p. 2). This does not take into consideration the tens of millions of dollars spent on "children requiring extensive treatment in hospital operating rooms", which was estimated to be more than $53 million in 2006 (The PEW Center on the States, 2010, p. 19).

According to 2011 Institute of Medicine Report, *Advancing Oral Health in America,* the surgeon general's report in 2000 estimated that 108 million people (35% of the population) did not have dental coverage, while in 2009 this number increased to 130 million (p. 3-4). Overall, the rates of the un-insured for oral health care services are almost three times the rates of un-insured for medical care services, 34.6 % versus 14.7 % respectively (IOM Report, 2011, p. 3-4).

Having dental coverage is a predictor of accessing dental care. The national Medical Expenditure Panel Survey (MEPS) shows that in 2004, "57% of individuals with private dental coverage had at least one dental visit, compared to 32% of those with public dental coverage and 27% of un-insured individuals" (IOM Report, 2011, p. 3-5). Lack of dental insurance increases out-of-pocket expenses leading to an increased financial burden for those seeking dental care. According to IOM Report (2011), "Dental services in 2008 accounted for 22% of all out-of-pocket health care expenditures, ranking second to prescription drug expenditures" (p. 3-5). Private funds accounted for 93% of the $101.2 billion in dental expenditures, while public funds accounted for the rest 7% (IOM Report, 2011, p. 3-5).

Medicaid provides health care coverage to nearly 30 million children while Children's Health Insurance Program (CHIP) covers an additional 6 million; together they provide coverage for 59% of low-income children (IOM, 2011. p. 3-7). Medicaid spending on dental services accounted for 1.3% of all Medicaid payments for the 2008 fiscal year (IOM, 2011. p. 3-8). Robinson et al., (2000) stated, "The prevalence of dental caries disease means that the financial cost of treating the disease worldwide is enormous" (p. 481).

Oral and craniofacial diseases and their treatment place a burden on society in the form of lost days and years of productive work. In addition, conditions such as oral and pharyngeal cancers contribute to premature death and can be measured by years of life lost.

Dental care may be a small fraction of overall health expenditures, but its significance is enormous because it has a lifetime effect on children. According to American Academy of Pediatric Dentistry (2009), "early detection and management of oral conditions can improve a child's oral health, general health and well-being, and school readiness" (p. 102). According to The PEW Center on the States (2010), "A good predictor of future decay is past experience with tooth decay", so when children with severe dental problems grow up to be adults they are more likely to experience severe dental problems and impaired ability to be productive members of the society (p. 19). More than 51 million school hours and 164 million work hours are lost each year because of dental-related illness (The PEW Center on the States, 2010, p. 16 &19).

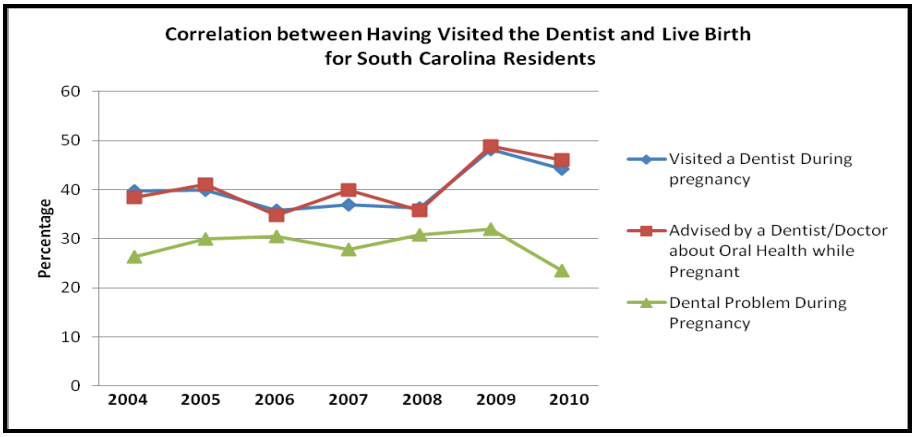
ii. Oral Disease and Other Health Conditions

Oral health and general health are integral to each other. Many systemic diseases and conditions including diabetes, HIV, and nutritional deficiencies have oral signs and symptoms. These manifestations may be the initial sign of clinical disease and therefore may serve to inform health care providers and individuals of the need for further assessment. The oral cavity is a portal of entry as well as the site for bacterial and viral infections that affect general health status. Recent research suggests that inflammation associated with periodontitis may increase the risk of heart disease and stroke; premature births in some women; difficulty in controlling blood sugar in persons with diabetes; and respiratory infection in susceptible individuals (Dasanayake 1998; Offenbacher et al. 2001; Davenport et al. 1998; Beck et al. 1998; Scannapieco et al. 2003; Taylor 2001). More research is needed in these areas.

- *Pregnant Women*

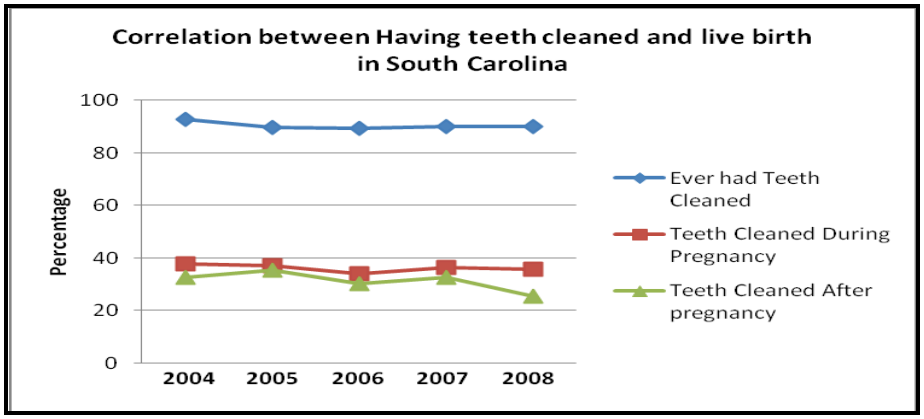
The current research suggests that some prenatal oral conditions may have adverse health consequences for the mother and young child. Improvements in maternal oral health care not only have the potential to improve the health care of mothers, but it may lower the risk of complication from dental diseases in women and lower the risk of early childhood tooth decay. There is also a connection between a mother's healthy mouth and healthy birth outcomes. The correlation between dental visits and teeth cleanings during pregnancy and live births is shown in Figure 27 and Figure 28.

Figure 27



Source: SC PRAMS 2010

Figure 28



Source: SC PRAMS 2008

- *Diabetes*

Diabetes is the major cause of heart disease and the seventh leading cause of death in the United States (National Diabetes Fact Sheet, 2011). According to the CDC, diabetes affects 25.8 million Americans, of those 10.9 million (26.9%) are people 65 years and older. Almost 79 million people 20 years and older have pre-diabetes in the United States (CDC, National Diabetes Fact Sheet, 2011).

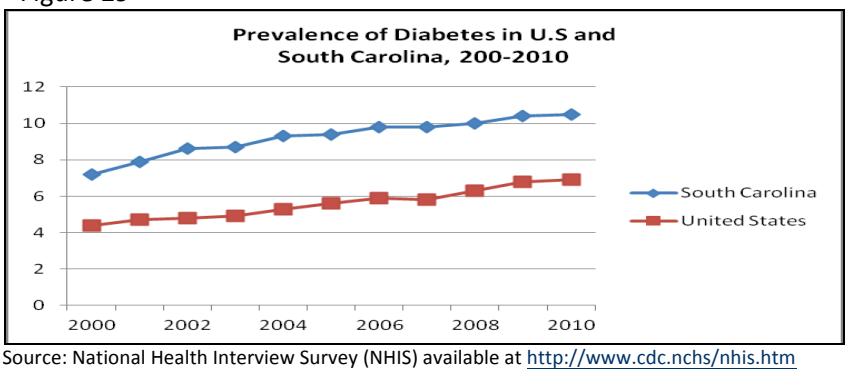
Diabetes is a known risk factor for both the development of oral disease and the prevalence of oral disease (Mealey and Oates, 2006). This relationship holds true regardless of whether a person suffers from Type I diabetes (formerly known as juvenile diabetes, in which the body does not produce any insulin at all) or Type II diabetes (the more common form, related to obesity, in which the body does not produce enough insulin or produces it inefficiently; American Diabetes Association, 2006). Diabetes reduces the body's resistance to infection thus putting the gums at risk. In addition, people who have inadequate blood sugar control may develop more-frequent and severe infections of the gums and the bone that holds teeth in place, resulting in increased tooth loss.

Periodontal (gum) disease is more common in people with diabetes. According to CDC 2011, young adults with diabetes have about twice the risk of periodontal disease. Adults aged 45 years or older with poorly controlled diabetes were 2.9 times more likely to have severe periodontitis than those without diabetes. The likelihood was even greater (4.6 times) among smokers with poorly controlled diabetes. About one-third of people with diabetes have severe periodontal disease consisting of loss of attachment (5 millimeters or more) of the gums to the teeth (CDC, National Diabetes Fact Sheet, 2011, p.9).

South Carolina ranks among the top ten states in the nation for diabetes prevalence. The prevalence of diabetes among adults in South Carolinians was 10.5% in 2010 (BRFSS), while the incidence is 11.9 per 1000 population. Although the national prevalence of diabetes has increased by 61% since 1998, in South Carolina it has increased by 88%.

The prevalence of diabetes in the United States and South Carolina in the past decade is shown in Figure 29. The prevalence of diabetes in South Carolina (10.5%) is 30% higher than the United States (6.95%).

Figure 29



Source: National Health Interview Survey (NHIS) available at http://www.cdc.nchs/nhis.htm

A snapshot comparison between of people with and without diabetes in South Carolina that had tooth loss by selected demographics is shown in Table X. The high proportion of people with diabetes that have tooth loss is associated with lower education levels and income. That proportion is also higher than non-diabetics in the same category. In addition Black diabetics are more likely to have had tooth loss compared to Whites and Hispanics. However, all race categories with diabetes have a higher rate of tooth loss compared to people without diabetes. Overall people with diabetes have more tooth loss than non-diabetics.

Table X: Proportion of People With and Without Diabetes in South Carolina that had Tooth Loss, By selected Demographics

	Diabetics (%) BRFSS 2010	Non-Diabetics (%) BRFSS 2010
Tooth Loss		
YES	78.8	47.6
NO	21.2	52.4
Age		
Age 35-44	68.3	40.5
Age 65-74	87	76
Race/Ethnicity		
White	74.2	43
Black or African American	83.6	59.3
Hispanic	64.2	22.8
Education		
Less than H.S	90.6	67
H.S. or G.E.D	81.4	58
Some College	80.4	46.7
College Graduate	59.2	32.2
Income		
Less than $15,000	91.6	64
$25,000- $34,999	84.7	57.2
$35,000- $49,999	81.9	54.2
$50,000 +	58.3	32.8

Source: SC BRFSS 2010

A snapshot comparison between of people with and without diabetes in South Carolina that did not have tooth cleanings, by selected demographics is shown in Table XI. Lower education levels and low income, results in a higher the proportion of people with diabetes that did not have teeth cleaned. This proportion is also higher than non-diabetics in the same category. Additionally, Black diabetics are more likely to not have teeth cleaned compared to Whites and Hispanics, but all race categories have a higher proportion of not having teeth cleaned. Overall non-diabetic people have their teeth cleaned more than diabetics.

Table XI: Proportion of People With and Without Diabetes in South Carolina that did Not have Tooth Cleaning, by selected Demographics

	Diabetics (%) BRFSS 2010	Non-Diabetics (%) BRFSS 2010
Tooth Cleaning		
YES	49.1	63.6
NO	50.9	36.4
Age		
Age 35-44	58.5	35.9
Age 65-74	44.7	27.9
Race/Ethnicity		
White	46.7	31.3
Black or African American	60.3	49.1
Hispanic	26.9	31.4
Education		
Less than H.S	75.6	64.2
H.S. or G.E.D	53.5	48.2
Some College	45.8	37.8
College Graduate	33.2	17.8
Income		
Less than $15,000	69.8	73.5
$15,000-$24,999	60.5	59.5
$25,000- $34,999	53.8	38.8
$35,000- $49,999	47	32
$50,000 +	30	18

Source: SC BRFSS 2010

- *Cardiovascular disease*

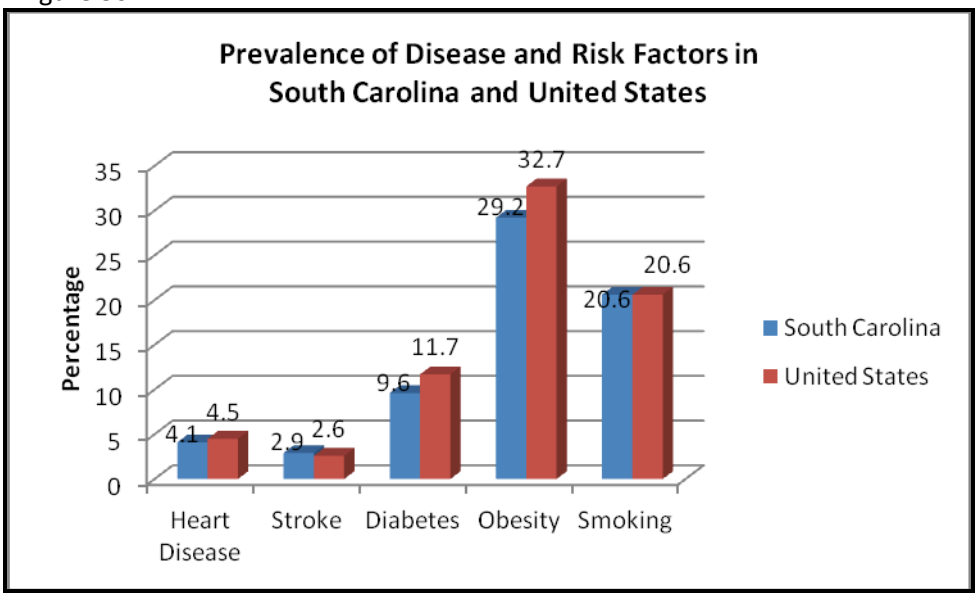
There have been several studies about the relationship between a healthy mouth and a healthy heart. People that have periodontal disease are more likely to develop heart disease. Our mouth is covered with bacteria, but most of them are harmless. Good oral health care, such as daily brushing and flossing, and the body's natural defense mechanism will maintain bacterial functions. However, harmful bacteria can sometimes grow out of control and cause oral infections, such as tooth decay and gum disease. In addition, dental procedures, medications, or treatments that reduce saliva flow can disrupt the normal balance of bacteria in the mouth or break the protective barriers in the mouth. This breakdown makes it easier for bacteria to enter the bloodstream. Oral health may affect, be affected by or contribute to various diseases and health conditions. This includes conditions such as endocarditis; cardiovascular disease; diabetes; HIV; low birth weight and even premature births.

The first and third leading causes of death for men and women are heart disease and stroke. These conditions are among the most widespread and costly health problems facing our nation today, yet they also are among the most preventable. Cardiovascular diseases, including heart

disease and stroke, account for more than one-fourth (25%) of all U.S. deaths. According to the CDC, more than 1 out of 3 adults in the United States, almost 83 million, live with some form of cardiovascular disease.

Almost 600,000 people die each year of heart disease and more than half of them occurred in men. According to the CDC, coronary heart disease costs $108.9 billion each year in the United States. The mortality rate of heart disease in United States in 2006 was 182.5 per 100,000 and mortality rate of stroke was 3 per 100,000 (data from NVSS, 2006). In 2006, the South Carolina the mortality rate per 100,000 of heart disease and stroke was 160.2 and 3.6 respectively (data from NVSS, 2006). The prevalence of heart disease, stroke and their risk factors in South Carolina and United States is shown in Figure 30. Data was taken from NHIS 2009 and NVSS 2006.

Figure 30



Source: CDC Heart and Stroke Maps available at http://apps.nccd.cdc.gov/NCVDSS_DTM/

V. Risk And Protective Factors Affecting Oral Diseases

The most common oral diseases and conditions can be prevented. Safe and effective measures are available to reduce the incidence of oral disease, reduce disparities, and increase quality of life.

a. Community Water Fluoridation

Community water fluoridation is the process of adjusting the natural fluoride concentration of a community's water supply to a level that is best for the prevention of dental caries. In the United States, community water fluoridation has been the basis for the primary prevention of dental caries for 66 years and has been recognized as one of 10 great achievements in public health in the 20th century (CDC 1999). It is an ideal public health method because it is effective, eminently safe, inexpensive, requires no behavior change by individuals, and does not depend on access or availability of professional services. Water fluoridation is equally effective in preventing dental caries among different socioeconomic, racial, and ethnic groups. Fluoridation helps to lower the cost of dental care and helps residents retain their teeth throughout life (USDHHS 2000a).

Not only does community water fluoridation effectively prevent dental caries, it is one of very few public health prevention measures that offer significant cost savings to almost all communities (Griffin et al. 2001). It has been estimated that about every $1 invested in community water fluoridation saves approximately $38 in averted costs. The cost per person of instituting and maintaining a water fluoridation program in a community decreases with increasing population size.

The frequent exposure to small amount of fluoride each day best reduces the risk of tooth decay in all age groups, therefore all persons should drink water with optimal fluoride concentration and brush their teeth twice daily with fluoride toothpaste (CDC 2001). Residents in communities that do not receive fluoridated water are at higher risk of tooth decay and additional fluoride measures might be needed.

Healthy People 2010 and Community Water Fluoridation

Recognizing the importance of community water fluoridation, *Healthy People 2010* Objective 21-9 was formulated to "Increase the proportion of U.S. population served by community water systems with optimally fluoridated water to 75 percent." In 2010, over 204.3 million persons (73.9 percent of the population served by public water systems) received optimally fluoridated water (CDC, 2010). Thus the goal of *Healthy People 2010* has nearly been achieved. According to the CDC, South Carolina has surpassed the *Healthy People 2010* goal with 93.8 percent of the population that is being served by public water systems receive fluoridated water (WFRS, 2012) Figure 31. About 76% of total population of South Carolina received fluoridated water, while 19 % receive water from private wells for which fluoride levels may not be reported (Figure 32). More data are available at http://www.cdc.gov/fluoridation/statistics.htm .

Figure 31

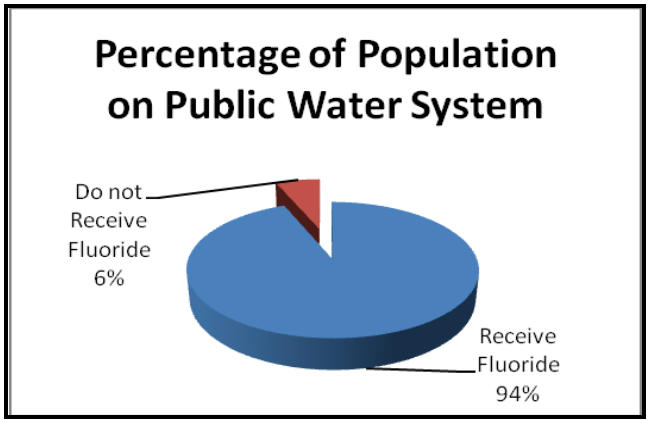
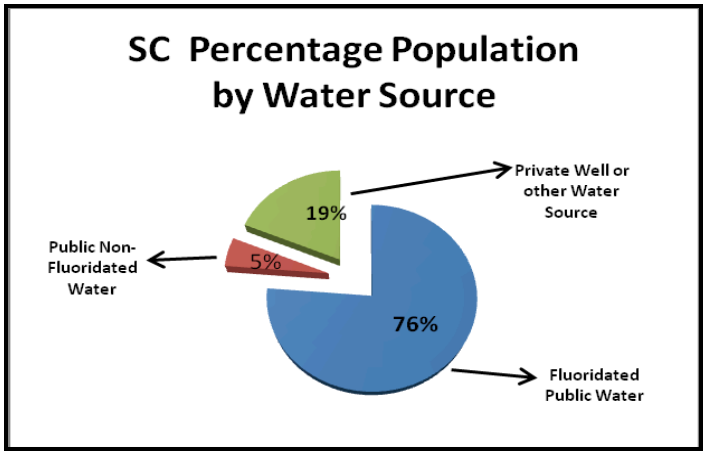


Figure 32



The South Carolina Water Fluoridation Equipment Mini-grant Program

The Mini-grant Program was implemented in 2004-2005 by DHEC through funding from the CDC Cooperative Agreement for a State-Based Oral Disease Prevention Program in an effort to ensure access to optimally fluoridated water in public water systems. To date, 22 water systems have received mini-grants through the DHEC program totaling $415,637. A list of the recipients and the amount of awards is shown in Table XII. This is based on data taken from the DOH Database of Public Water Systems.

Table XII: SC Drinking Water Fluoridation Equipment Mini-Grant Program Awards: Year, Grantee Name, Amount rewarded

Date	Award Recipient	Award Amount	Accept/Decline	Grant Total	Total to Date
2004/2005	Easley	34,670.00	Accept		
	Florence	10,330.00	Accept		
	Gaffney	31,000.00	Accept		
			TOTAL AWARDED	$76,000.00	**$76,000.00**
2005/2006	Bennettsville	31,357.00	Accept		
	Florence	13,250.00	Accept		
	Pickens	14,107.00	Accept		
	Westminster	17,286.00	Accept		
			TOTAL AWARDED	$76,000.00	**$152,000.00**
2006/2007	Rock Hill	21,345.00	Accept		
			TOTAL AWARDED	$21,345.00	**$173,345.00**
2007/2008	Georgetown Co. Water and Sewer	6,459.52	Accept		
	Spartanburg Water	54,700.00	Accept		
			TOTAL AWARDED	$61,159.52	**$234,504.52**
2008/2009	City of West Columbia	30,000.00	Accept		
	Greenwood CPW	3,138.00	Accept		
	Florence	5,862.00	Accept		
			TOTAL AWARDED	$39,000.00	**$273,504.52**
2009/2010	City of Walhalla	8,000.00	Accept		
	Florence	8,500.00	Accept		
	Greenwood CPW	11,870.00	Accept		
	Greer CPW	11,142.00	Accept		
			TOTAL AWARDED	$39,512.00	**$313,016.52**
2010/2011	City of Abbeville	25,092.00	Accept		
	McCormick CPW	15,908.00	Accept		
			TOTAL AWARDED	$41,000.00	**$354,016.52**
2011/2012	Belton-Honea Path	21,764.50	Accept		
	Lugoff-Elgin	21,764.50	Accept		
			TOTAL AWARDED	$43,529.00	**$397,545.52**
2012/2013	City of Pickens(Pickens Twelve Mile River WWTP)	18,092.00	Accept		
			TOTAL AWARDED	$18,092.00	**$415,637.52**

Source: SC Division of Oral Health Database, 2012

b. Topical Fluorides and Fluoride Supplements

Because frequent exposure to small amounts of fluoride each day will best reduce the risk of dental caries in all age groups, all people should drink water with an optimal fluoride concentration and brush their teeth twice daily with fluoride toothpaste (CDC 2001). For communities that do not receive fluoridated water and persons at high risk of dental caries, additional fluoride measures might be needed. Community measures include fluoride mouth rinse or tablet programs, which typically are conducted in schools. Individual measures include professionally applied topical fluoride gels or varnish for persons at high risk of caries.

The application of fluoride varnish to the tooth surface is an effective way to prevent and in some cases stop tooth decay. Fluoride varnish provides a thin coating of 5% sodium fluoride that is available in a choice of flavors, white or yellow colors and varying package sizes. After the varnish is applied to the tooth surfaces, it forms a sticky layer, which hardens when it comes in contact with saliva. Fluoride is then absorbed into the enamel of the tooth from the hardened varnish. It is recommended that the varnish be allowed to remain on the teeth for up to five hours for optimal absorption.

The purpose of applying fluoride varnish is to retard, arrest, or reverse the process of tooth decay in children at high to medium risk for dental caries. Most studies have shown 25-45% reductions in the decay rate with the use of fluoride varnish.

The American Academy of Pediatrics has endorsed the child-focused modules of the Society for Teachers of Family Medicine *Smiles for Life* National Oral Health Curriculum. This curriculum is designed to educate primary care clinicians in the promotion of oral health for all age groups. Course 2 discusses children's oral health and Course 6 provides the rationale and procedures for fluoride varnish application.

Access *Smiles for Life* at: http://www.smilesforlifeoralhealth.org/ .

School Dental Prevention Programs in South Carolina have provided fluoride varnish for 82,962 children in the school setting in 2008-2012 school years (SC DOH SDPP 2008-2012 Annual Evaluation Report).

c. Dental Sealants

Since the early 1970s, the incidence of childhood dental caries on smooth tooth surfaces (those without pits and fissures) has declined markedly because of widespread exposure to fluorides. Most decay among school age children now occurs on tooth surfaces with pits and fissures, particularly the molar teeth.

A dental sealant is a thin protective coating of plastic resin or glass ionomer that is applied to the chewing surfaces of teeth to prevent food particles and bacteria from collecting in the normal pits and fissures and developing into caries. A Cochrane review of sealant studies found that resin-based sealants were effective at preventing caries, ranging from 87% reduction in caries after 12 months to 60% at 48-54 months (Ahovuo-Saloranta et al., 2008).

Sealants are most effective when placed on fully erupted molars (Dennison et al., 1990). Sealants can also be placed over non-cavitated carious lesions to reduce the progression of the lesions (Griffin et al., 2008).

Pit-and-fissure dental sealants—plastic coatings bonded to susceptible tooth surfaces—have been approved for use for many years and have been recommended by professional health associations and public health agencies. First permanent molars erupt into the mouth at approximately 6 years of age. Placing sealants on these teeth shortly after their eruption protects them from the development of caries in areas of the teeth where food and bacteria are retained. If sealants were applied routinely to susceptible tooth surfaces in conjunction with the appropriate use of fluoride, most tooth decay in children could be prevented (USDHHS 2000b).

Second permanent molars erupt into the mouth at about age 12 to 13 years. Pit-and-fissure surfaces of these teeth are as susceptible to dental caries as the first permanent molars of younger children. Therefore, young teenagers need to receive dental sealants shortly after the eruption of their second permanent molars.

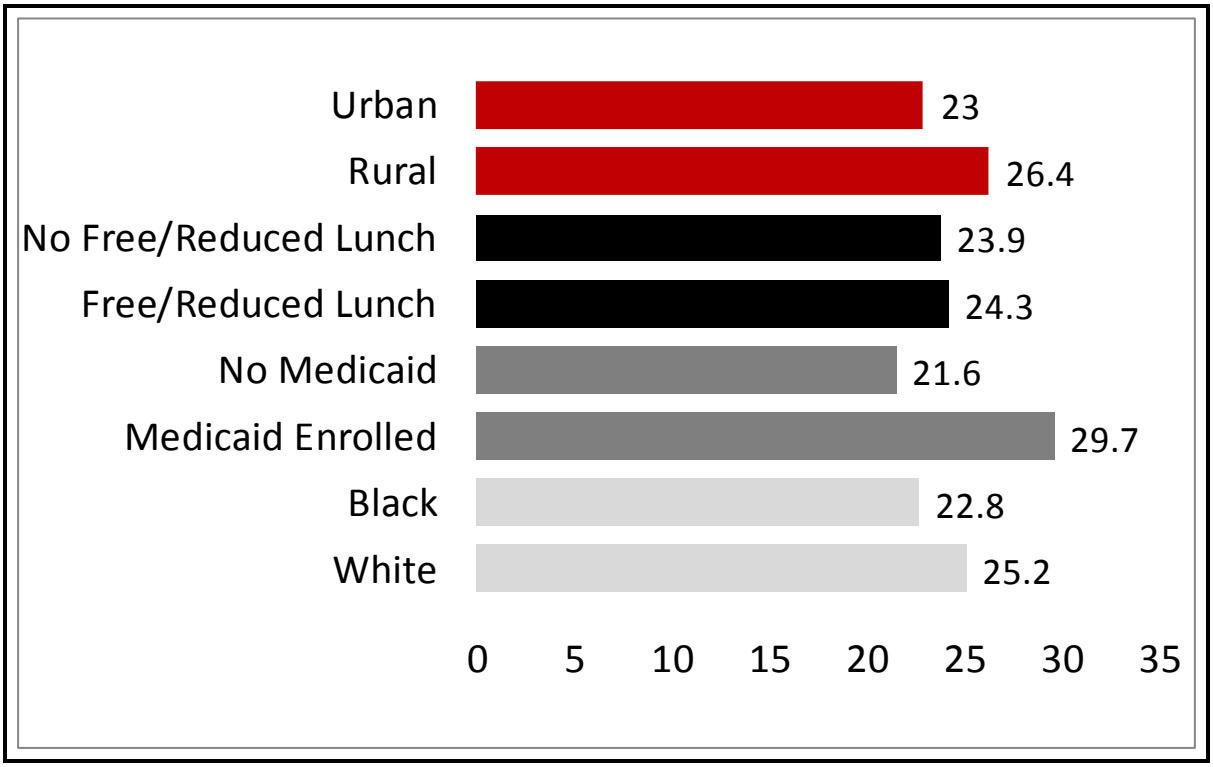
The *Healthy People 2010* target for dental sealants on molars is 50 percent for 8-year-olds and 14-year-olds. The most recent estimates of the proportion of children aged 8 years with dental sealants on one or more molars are presented in Table XIII. Within each age group, Blacks and Mexican Americans are less likely than non-Hispanic Whites to have sealants. The prevalence of sealants also varies by the education level of the head of household.

Despite their effectiveness, few children receive sealants. The most recent NHANES (1999–2004) data indicate that 32 percent of 8-year-olds and 21 percent of 14-year-olds have sealants on their permanent molars (Dye et al., 2007). While this is a significant increase over the 23 percent of 8-year-olds and 15 percent of 14-year-olds with sealants in 1988–1994, it falls short of the *Healthy People 2010* goal of 50 percent of both groups (Dye et al., 2007; HHS, 2000a).

Unfortunately, low-income children, who are most likely to have caries, are the least likely to receive sealants (Dye et al., 2007). Sealants can be applied in a dental office or in a community-based program, such as school-based sealant programs. Many sealant programs strive to target high-risk populations because this has proven to be effective for the prevention of caries as well as to demonstrate cost savings (Pew Center on the States, 2010). The evidence that school-based sealant programs decrease decay is strong, and they are recommended by the Task Force on Community Preventive Services (see Chapter 4). However, evidence is insufficient to comment on the effectiveness of less targeted state- or communitywide programs (Truman et al., 2002).

The South Carolina 2008 Needs Assessment analysis of sealants, which was limited to children enrolled in 3rd grade due to age-appropriate guidelines of sealants, demonstrated that 23.9% of third graders had sealants. Children enrolled in Medicaid had the highest rate of sealant use (29.7%), which was significantly higher from children not enrolled in Medicaid (21.6%). No differences in sealant use were detected for other subgroup comparisons (Figure 33).

Figure 33 **Proportion of Children with Sealants by selected Subgroups**



Source: SC 2008 Oral Health Needs Assessment

While no race-based disparities were observed for sealants, the rate is lower than *Healthy People 2010* target of 50%. One of the most compelling outcomes from the 2008 Oral Health Needs Assessment was that children enrolled in Medicaid were experiencing higher rates of tooth decay, but were most connected to care, as demonstrated by greater sealant use and lower untreated decay and treatment urgency. Comparison data on children with sealants between United States and South Carolina is shown in Table XIII.

Table XIII. Percentage of Children in United States and South Carolina with Dental Sealants on Molar Teeth, by Selected Characteristics

	United States 2004 (%)	South Carolina[a] 2008 (%)
HP2010 Target	50	50
Total	32	23.9
Race		
White	38	25.2
Black	23	22.8
Hispanic		25.8
Sex		
Male	32	23.7
Female	32	24.6
Education Level		
Less than high school	18	DNC
High school or G.E.D.	28	DNC
Some college	41	DNC

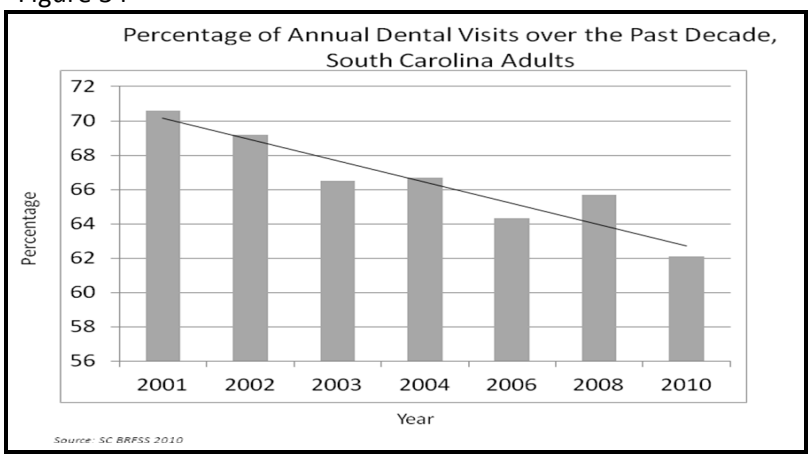
TableXIII Sources:
Healthy People 2010 database, at: http://wonder.cdc.gov/data2010/focus.htm
South Carolina 2008 Oral Health Needs Assessment
DNC= Data Not Collected

d. Preventive Visits

Maintaining good oral health takes repeated efforts on the part of the individual, caregivers, and health care providers. Daily oral hygiene routines and healthy lifestyle behaviors play an important role in preventing oral diseases. Regular preventive dental care can reduce the development of disease and facilitate early diagnosis and treatment. One measure of preventive care that is being tracked, as shown in Table VIII, is the percentage of adults who had their teeth cleaned in the past year. Having one's teeth cleaned by a dentist or dental hygienist is indicative of preventive behaviors.

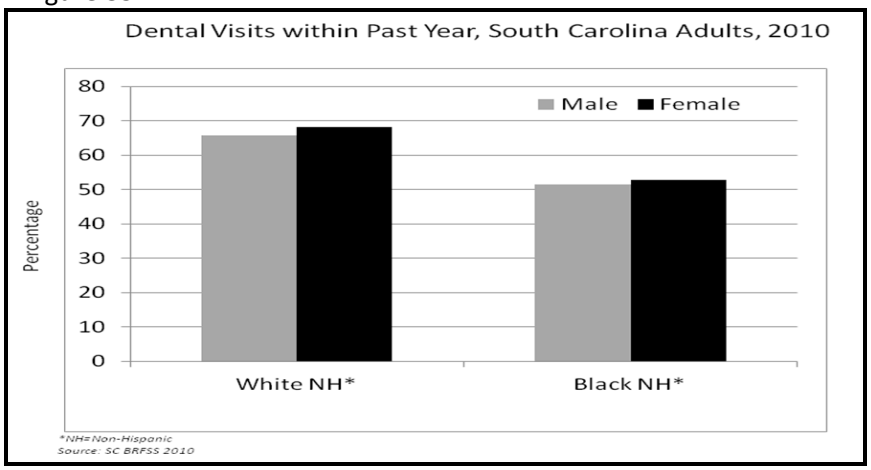
Routine Dental Visit Trend. Dental visits can detect early signs of oral health problems that can prevent further damage, and in some cases, reverse the problem. Over the past decade there has been a significant albeit steady decline in the proportion of SC adults who routinely visit an oral health professional for proper care. From 2001 to 2010 the percentage of annual dental visits decreased 12% from 70.6% to 62.1%. Annual dental visits trend over the past decade is shown in Figure 34.

Figure 34



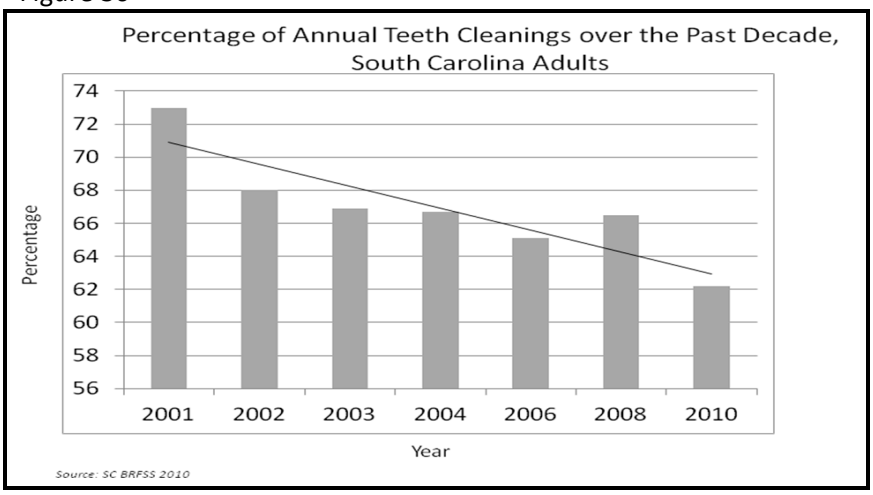
In 2010, approximately 62% of adults in South Carolina visited a dentist or dental clinic within the past year for various reasons. While little difference is noticed among men and women, a significant difference is seen among racial ethnic groups. As shown here, Non-Hispanic Black men and women are significantly less likely, than are Non-Hispanic White men and women, to visit a dentist or other dental specialist for annual oral health checkups. This difference is shown in Figure 35.

Figure 35



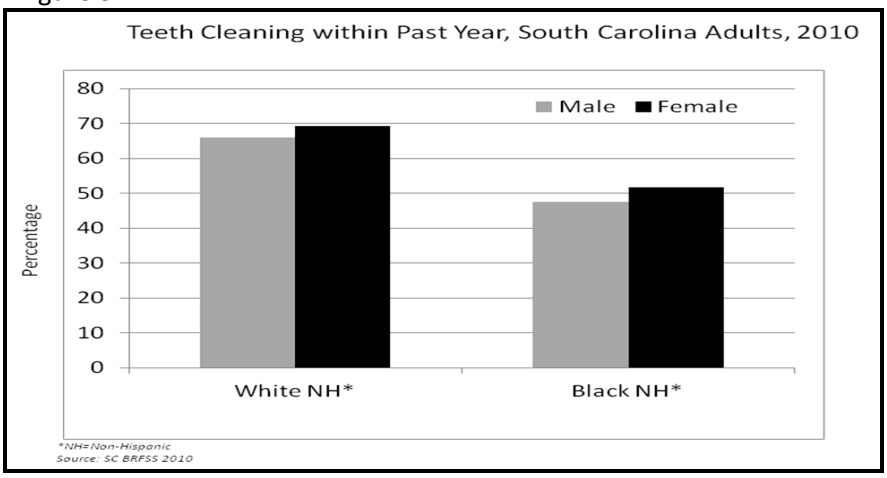
Routine Dental Cleaning Trend. Poor oral health can significantly affect quality of life. On average, teeth cleaning performed by a dental professional should be done every 6 months and is essential for maintaining good oral health. Over the past decade, just like routine dental visits, there has been a significant decrease in the percentage of SC adults who receive at least one professional dental cleaning a year. From 2001 to 2010 the percentage of teeth cleanings decreased 14.8% from 73% to 62.2%. This trend is shown in Figure 36.

Figure 36



In 2010, a little over 62% of adults in South Carolina visited a dentist or dental hygienist within the past year for teeth cleaning. Similar to dental visits, there is little difference in routine teeth cleaning among genders and a significant difference among racial ethnic groups. As shown in Figure 37, Non-Hispanic Black men and women are significantly less likely to have their annual teeth cleaning by a dentist or dental hygienist, compared to Non-Hispanic men and women.

Figure 37



A comparison between United States and South Carolina percentage of adults that had their teeth cleaned in the past year, by age, gender, race, education level and income is shown in Table XIV.

Table XIV. Percentage of Adults Aged 18 Years or Older Who Had Their Teeth Cleaned Within the Past Year, BRFSS 2008

	United States (%)	South Carolina[a] Status (%)
Total	69	66.5
Age		
18 – 24 years	66.4	67.4
25 – 34 years	62.4	62.5
35 – 44 years	68.7	64.2
45 – 54 years	70.2	68.1
55 – 64 years	73.9	70.5
65 + years	74.2	68.1
Race		
White	72.3	72.7
Black	58.6	52.8
Hispanic	62	n/a
Other	64	n/a
Multiracial	56	n/a
Sex		
Male	66.6	64.7
Female	71.4	68.1
Education Level		
Less than high school	49.1	35.8
High school or G.E.D.	62	56.5
Some post high school	68.9	68.3
College graduate	80	84
Income		
Less than $15,000	46.8	36.3
$15,000 – 24,999	52.1	43
$25,000 – 34,999	60	56
$35,000 – 49,999	67.3	63.6
$50,000+	80.21	82.4

Sources: Division of Adult and Community Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, *Behavioral Risk Factor Surveillance System Online Prevalence Data,* 2008. Available at www.cdc.gov/brfss.
[a] BRFSS 2008/South Carolina

e. Screening for Oral Cancer

Oral cancer detection is accomplished by a thorough examination of the head and neck; an examination of the mouth including the tongue, the entire oral and pharyngeal mucosal tissues, and the lips; and palpation of the lymph nodes. Although the sensitivity and specificity of the oral cancer examination have not been established in clinical studies, most experts consider early detection and treatment of precancerous lesions and diagnosis of oral cancer at localized stages to be the major approaches for secondary prevention of these cancers (Johnson 1999). If

suspicious tissues are detected during an examination, definitive diagnostic tests, such as biopsies, are needed to make a firm diagnosis.

Oral cancer is more common after the age of 60 years. Known risk factors include use of tobacco products and alcohol. The risk of oral cancer is increased 6 to 28 times in current smokers. Alcohol consumption is an independent risk factor and, when combined with the use of tobacco products, accounts for most cases of oral cancer in the United States and elsewhere (USDHHS 2004a). Individuals should also be advised to avoid other potential carcinogens, such as exposure to sunlight (a risk factor for lip cancer) without protection (use of lip sunscreen and hats is recommended). Recent studies show that 60% of oro-pharyngeal cancers are associated to HPV.

Recognizing the need for dental and medical providers to examine adults for oral and pharyngeal cancer, *Healthy People 2010* Objective 21-7 is to increase the proportion of adults who, in the past 12 months, report having had an examination to detect oral and pharyngeal cancers. Nationally, relatively few adults aged 40 years and older (18%) reported receiving an examination for oral and pharyngeal cancer, although the proportion varied by race/ethnicity (Table XV).

Table XV. Proportion of Adults in the United States Who Were Examined for Oral and Pharyngeal Cancer in the Preceding 12 Months

	United States (%) Baseline (1988-94)	United States (%) (2008)
Healthy People 2010 Target	20	20
U.S Total	13	18
Race/Ethnicity		
White	14	20
Black or African American	7	8
Hispanic	6	7
American Indian or Alaska Native	13	DSU
Gender		
Male	12	17
Female	14	20
Education		
Less than H.S	5	4
Some post H.S	10	13
College Graduate	19	25

Table XV Sources: *Healthy People 2010* database, at: http://wonder.cdc.gov/data2010/focus.htm
DSU: Data do not meet the criteria for statistical reliability, data quality, or confidentiality

Nationally, 33% of oral cancers were detected at the earliest stage in 2006. However the proportion is lower for males and minority populations (Table XVI).

Table XVI. Proportion of Oral Cancer Cases Detected at the Earliest Stage, by Selected Demographic Characteristics

	Baseline (%) (1988-94)	United States (%) (2004)	United States (%) (2006)
Healthy People 2010 Target	51	51	51
U.S Total	36	35	33
Race/Ethnicity			
White	39	38	34
Black or African American	22	22	25
Hispanic	33	34	33
American Indian or Alaska Native	26	28	25
Gender			
Male	34	33	28
Female	40	41	42

Table XVI Sources:
Healthy People 2010 database, at: http://wonder.cdc.gov/data2010/focus.htm

f. Tobacco Control

There is a vast body of literature documenting the adverse effects of cigarette smoking on health. In 2000, the Surgeon General's report on oral health noted that lifestyle behaviors such as smoking affect oral health, as well as, general health. The report also emphasized the importance of oral health to overall health.

Tobacco prevention and cessation is a very important issue for public health and is one of the goals of *Healthy People 2010*. Having such a strong impact internationally, smoking also has an impact in our nation, state and community. Smoking and tobacco use increases the risk for health problems as well as causes social and financial issues for the entire community. The concern is not only to help people stop smoking, but also to prevent and to educate new generations about the risks of smoking.

The crusade against tobacco use and smoking has been one of the most talked about and worked on issue that has faced our society for decades. According to the CDC Mortality and Morbidity Weekly Report (MMWR), almost 18 % of adult population in US continue to smoke (2008). Tobacco is one of the leading factors of death in the US, leading to almost 443,000 deaths each year, in which 49,400 of them are due to secondhand smoking (CDC, MMWR, 2008). Smoking deaths surpass the amount of deaths caused by HIV, alcohol and drug abuse, accidents, suicides and murders combined (Walsh, 2003, p.20).

There are several health risks known to derive from smoking and tobacco use. According to Gupta (2001), smoking can cause lung cancer, respiratory diseases, oral cancer, esophagus cancer, heart disease, heart arrhythmia which is associated more with chewing tobacco (pp.475-

478). Similarly, people exposed to secondhand smoking can also suffer from respiratory diseases, lung cancers and heart disease (Gupta 2001, p. 479). There are about 60 known carcinogens associated with environmental tobacco smoke (ACS, *Secondhand smoke section,* 2009), without any scientifically established safe levels (Gupta 2001, p. 485). Studies have shown a link between pregnant women smoking or being exposed to second hand smoking and low birth weight babies (Reeves & Bernstein, 2008). Smoking shifts the infant mortality curve, demonstrating that at any measure of birth weight, infant mortality is higher (Reeves & Bernstein 2008, para. 2). If smoking patterns continue, there will be more than 1 billion deaths in the 21st century attributable to smoking, compared to 100 million deaths in the 20th century (Vineis, 2008, p.182).

Comprehensive tobacco control would also have a large impact on oral health status. The goal of comprehensive tobacco control programs is to reduce disease, disability, and death related to tobacco use by:

- Preventing the initiation of tobacco use among young people.
- Promoting quitting among young people and adults.
- Eliminating nonsmokers' exposure to secondhand tobacco smoke.
- Identifying and eliminating the disparities related to tobacco use and its effects among different population groups.

Data from the National Health Interview Survey, 2008

- Current smokers (16%) were twice as likely as former smokers (8%) and four times as likely as never smokers (4%) to have poor oral health status.
- Current smokers (35%) were almost one and one-half times as likely as former smokers (24%) and more than two times as likely as never smokers (16%) to have had three or more oral health problems.
- Current smokers (19%) were about twice as likely as former smokers (9%) and never smokers (10%) to have not had a dental visit in more than 5 years or have never had one.
- Cost was the reason that most adults with an oral health problem did not see a dentist in the past 6 months; 56% of current smokers, 36% of former smokers, and 35% of never smokers could not afford treatment or did not have insurance.

Tobacco use is an important issue not only at the national level but also at the state level, community level and individual level. According to the CDC, South Carolina is one of the unhealthiest states in the country and ranks 34th in the nation for tobacco use with 24.3% of adults smoking and 20.9% of youth smoking (CDC, *State highlights section,* 2010). In South Carolina 90% of smokers reported that they had started smoking as teenagers (CDC, *State highlights section,* 2010). DHEC reports that 18.7% of high school students have smoked in the past 30 days (Youth Tobacco Survey 2007) and 26.1% of 18-24 years old smoke, thus making smoking more prevalent on college age people than any other age group (Adult Tobacco Survey 2007). According to the 2008 USC National College Health Assessment (NCHA), 18.8% of students reported to have smoked in the past 30 days and 11.2% of faculty and staff are current smokers, while one in ten college students will die prematurely from tobacco use.

The concern is not only to help people quit, but also to prevent and to educate new generations about the risks of smoking. Tobacco use and smoking are preventable diseases that remain one of the leading causes of death in the nation and world; even in the midst of the 21st century these preventable diseases kill approximately 4 million people each year (Gupta, 2001, p.475). If the current patterns of tobacco use continue, it is estimated that in the year 2020, deaths caused by smoking will be doubled to almost 8.4 million people each year (Gupta 2001, p.475). Tobacco prevention and cessation is a key public health issue that is embedded within Healthy People 2010 initiatives. Smoking causes heath risks, as well as, social and financial problems for the entire community. Healthcare costs are approximately $1.01 billion each year in SC, while people who smoke spend 26% more in health services and 28% more in medications than non-smokers (Healthy Carolina, State facts section). Reduction in the use of tobacco products is one of the objectives of the Tobacco prevention program. According to Vineis (2008), implementation of such interventions could avert 13.8 million deaths in the world over a period of 10 years at a cost of $0.40 per person/ year in lower-middle income countries and $0.50-$1.00 per person/ year in upper- middle income countries such as the US (p.182).

The dental office provides an excellent venue for providing tobacco intervention services. More than one-half of adult smokers see a dentist each year (Tomar et al. 1996). Dental patients are particularly receptive to health messages at periodic check-up visits, and oral effects of tobacco use provide visible evidence and a strong motivation for tobacco users to quit. Dentists and dental hygienists can be effective in treating tobacco use and dependence. The identification, documentation, and treatment of every tobacco user they see needs to become a routine practice in every dental office and clinic (Fiore et al. 2000).

Data from the Youth Risk Behavior Surveillance System (YRBSS) on students who smoked or used other tobacco products are shown in Table XVII. Cigarette smoking among adults 18 years older in US and South Carolina is described in Table XVIII.

Table XVII. Percentage of Students in High School (Aged 12–21 years) Who Smoked Cigarettes daily in the Past 30 Days by grade, gender and race in 2011.

	United States	South Carolina
8th grade		
Total	2.9	11.5
Gender		
Male	3.5	15.6
Female	2.3	7.3
Race/ethnicity		
White	3.2	13.9
Black	1.9	7.2
Hispanic	2.3	n/a
10th grade		
Total	6.6	11.2
Gender		
Male	7.2	12.7
Female	5.9	9.6
Race/ethnicity		
White	7.4	13.4
Black	3.5	n/a
Hispanic	4.4	n/a
12th grade		
Total	10.7	15.8
Gender		
Male	12.3	19.3
Female	8.7	12.8
Race/ethnicity		
White	13.5	21
Black	5.3	8.2
Hispanic	5.7	n/a

Source: Division of Adolescent and School Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Youth Risk Behavior Surveillance System Online.
YRBSS 2011 available at http://apps.nccd.cdc.gov/YouthOnline/App/Results.

Table XVIII. Cigarette Smoking Adults Aged 18 Years and Older

Healthy People 2010 Target 12%	United States 2008	South Carolina 2006
Total	21	23
Race or Ethnicity		
American Indian or Alaska Native	24	56
Black or African American	21	17
White	23	25
Hispanic or Latino	15	22
Not Hispanic or Latino	22	23
Sex		
Female	18	20
Male	23	25
Education		
Less than H. S	30	40
Graduate H.S.	28	25
Some College	22	16
Graduate College and above	9	12

Source: *Healthy People 2010 database at* http://wonder.cdc.gov/scripts/broker.exe

g. Oral Health Education

Oral health education for the community is a process that informs, motivates, and helps people to adopt and maintain beneficial health practices and lifestyles; advocates environmental changes as needed to facilitate this goal; and conducts professional training and research to the same end (Kressin & DeSouza 2003). Although health information or knowledge alone does not necessarily lead to desirable health behaviors, knowledge may help empower people and communities to take action to protect their health.

The SC DOH objectives within the Early Childhood chapter of the SOHP led to the creation of a resource to address the identified needs of the pregnant mother*, Oral Health Care for Pregnant Women.* (SC State Oral Health Plan, Population III: Early Childhood, Access at: http://www.scdhec.gov/health/mch/oral/plan.htm .
The South Carolina recommendations were based on the New York State Department of *Health Oral Health Care during Pregnancy Practice Guidelines* and became an effective tool for implementing the Early Childhood Chapter of the SC implementing the Early Childhood Chapter of the SC SOHP as it relates to oral health during the prenatal period.

Given the importance of oral health to women's overall health and well-being, and the growing body of scientific evidence related to its association with birth outcomes, it is vital South Carolina health professionals work together to ensure pregnant women receive oral health education, counseling, and access to the oral health care.

The 2003 Dental Practice Act established the role of the SC DHEC to coordinate the public health dental prevention program delivered by public-private partnerships. The South Carolina SDPP is comprised of five dental programs that enter yearly into a Memorandum of Agreement with DHEC to deliver preventive dental services, including sealants, in public health settings.

The School-Based Dental Sealant Program Management Team (SBDSP) uses a collaborative management approach. The Program Coordinator coordinates the activities of the SBDSP Management Team. The Director of the Division of Oral Health participates and provides technical support. The Administrative Assistant serves on the team and manages the inventory database. The Dental Consultant reviews policies and program operations and provides training on the ASTDD Basic Screening. The Evaluation Consultant provides technical assistance to the Epidemiologist and the Office of Research and Statistics as needed. The Education Consultant provides technical assistance related to educational materials.

Oral Health Education In Schools

South Carolina's Comprehensive Health Education Act of 1988 (CHEA) includes dental health as a part of the kindergarten to grade five module. For middle and high school students, substance use (tobacco) also is a part of the curriculum.

The South Carolina SDPP enrolls public and private providers who agree to provide school-based oral health services in their local community and to operate within the *School-Based Dental Prevention Program Guidelines*.

During the 2011-12 school year, 401 schools throughout the state were served by these programs. Of the 21,888 children who were screened and 9,596 children received one or more dental sealants on their molar teeth.

Educational Resources for Teaching Oral Health

The South Carolina Healthy Schools Program, under the guidance of the Office of Adult and Community, developed several oral health curriculum resource guides in 2003. In addition to being valuable resources for the citizens of our state, the development of these materials has solidified community partnerships with groups such as Head Start and EdVenture Children's Museum. These collaborative efforts provide DHEC with a way to distribute materials, train providers and educate parents, children and community leaders.

These guides contain lessons that teach oral health concepts and encourage them to take care of their teeth. Each of the student activities in the *Oral Health Supplemental Resource Guides* includes a list of needed materials, background information, step-by-step instructions and suggested extension and evaluation activities. These guides are primarily designed for classroom use and for parental education:

- **The Oral Health Supplemental Curriculum Resource Guides.** The lessons and activities for Kindergarten, second and seventh grade students were designed to reinforce the health and safety learning standards at these grade levels. The Oral Health Supplemental Curriculum Resource Guides were funded through CDC DASH

Cooperative Agreement U58/CCU417047-03-02 and South Carolina Healthy Schools at the State Department of Education.

- **The Oral Health Supplemental Curriculum Resource Guide for Preschool,** This guide was developed in 2005. It draws from and was designed to be part of the original oral health curriculum resource series.
- An additional set of resources was developed for early childhood educators. **The Oral Health Teacher Activity Guide for Infants through Preschool** is filled with developmentally appropriate activities that can be done within the childcare setting. As a companion to the Activity Booklet, the **Oral Health Parent Information Booklet** provides parents and caregivers with valuable information about caring for teeth, eating healthy foods, preventing injuries and visiting the dentist.
- The **Oral 101 Health Training and Dental Emergency Training**, approved Center for Child Care Career Development courses, provide childcare providers and community outreach program coordinators with valuable training and information that is in line with the information in the Teacher Activity and Parent Information Booklets.
- The final resource to be added to the collection of oral health materials is **Oral Health for Families with Special Health Care Needs.** This information is designed for families dealing with a special health care issue that may directly impact their child's oral health.

These materials are based on the *Stepping Stones for Caring for Our Children* and the *Bright Futures Guidelines for Oral Health*

Oral Health Education in the Community

The DOH and its partners provide assistance to South Carolina communities in designing and establishing activities to prevent oral disease. Community meetings have been held to identify particular needs of the community and to make plans for appropriate actions. DHEC's DOH and its partners conduct educational outreach targeting those South Carolina counties with the greatest burden of oral disease. The campaigns are designed to raise public awareness on the importance of improving oral health.

CHCs provide family-oriented primary and preventive health care services for people living in rural and urban medically underserved communities. CHCs exist in areas where economic, geographic, or cultural barriers limit access to primary health care. The MHP supports the delivery of migrant health services, serving more than 650,000 migrant and seasonal farm workers. Among other services provided, many CHCs and Migrant Health Centers provide dental care services.

Education of the Oral Health Workforce

In South Carolina, the only four-year dental training program is offered at the Medical University of South Carolina, which offers a joint D.M.D./Ph.D. program in addition to the standard curriculum. Post-doctoral training is available in general dentistry, oral and maxillofacial surgery, pediatric dentistry, and periodontics.

Palmetto Richland Hospital in Columbia has a general practice dental residency program. It is a one year certificate program, and also includes rotations in anesthesia and in family medicine. Nearly all of the resident's time is spent providing dental care at Palmetto Richland clinic sites.

There are six technical colleges across the state that trains dental hygienists. A dental hygiene associate program takes two years and provides academic study in basic and dental sciences as well as clinical experience, which renders the student eligible to take the national and state licensing exams. Some colleges also offer a one-year dental assisting program. Continuing education for dental hygienists, dental assistants, and dental office professionals is also available either on campus or online.

Healthy People 2020

The *Healthy People 2020* objectives reflect national objectives for improving the oral health of all Americans over the next 10 years. Therefore, the SC SOHP will be updated with the new benchmarks and targets established for *Healthy People 2020*. The overarching goals of *Healthy People 2020* will provide the structure and guidance for achieving the stated oral health objectives. While general in nature, they offer important areas of emphasis where action must be taken if the United States and South Carolina is to achieve better health by the year 2020.

VI. Provision Of Dental Services

a. Dental Workforce and Capacity

Maintaining a strong dental workforce is critical to society's ability to deliver high-quality oral health care in the United States. Effective health policies intended to expand access, improve quality, or constrain costs must take into consideration the supply; distribution; preparation, and utilization of the health workforce (see http://bhpr.hrsa.gov/healthworkforce/reports/profiles).

- Dentists

According to the South Carolina Dental Practice Act, a dentist is a legally qualified practitioner that can "diagnose and treat disease, lesions or conditions of the oral cavity and associated adjacent structures or anything in the curriculum of an accredited dental college" (SC Code Ann 40-15-70).

According to the South Carolina Office for Healthcare Workforce Analysis and Planning Report (April 2012), there were a total of 2637 licensed and practicing dentists in South Carolina in 2011. Only 2068 of them were available to civilian population and made up the dentist workforce in the state. In 2011 there was a ratio of 4.4 dentists per 10,000 population in the state, while in 2009 number of dentists per 10,000 people was 6.1 in the nation. Nationwide, the supply of dentists in rural counties is less than half of the urban counties, with 2.9 dentists per 10,000 residents in the most rural counties compared to 6.1–6.2 dentists per 10,000 residents in large metropolitan areas (IOM, 2011, p. 2-10). In urban areas this ratio was 5.0, while in rural areas the ratio per 10,000 population was 2.7 dentists. There is not much change in the ratio since 2009 despite the growth of the population as well as the number of dentists.

- Dental hygienists

Dental Hygienists are licensed healthcare professionals who provide preventive, therapeutic and educational services (SC Code Ann 40-15-80). The Dental Practice Act of 2003 Section 40-15-110 allows hygienists to provide preventive dental services under the DHEC Dental Public Health Program; however, DHEC does not have funding to implement. South Carolina Dental Practice Act (SC Code Ann Title 40 Chapter 15) calls for direct supervision of Dental hygienists, thus their distribution follows that of the dentists. There are 2,381 licensed dental hygienists in South Carolina as of December 2010 (SC AHEC, 2011).

There are 26 counties with less than four dental hygienists per 10,000 populations and 11 of them with less than 1 hygienist per 10,000 population (SC AHEC).

b. Dental Workforce Diversity

One cause of oral health disparities is a lack of access to oral health services among under-represented minorities. Increasing the number of dental professionals from under-represented racial and ethnic groups is viewed as an integral part of the solution to improving access to care for these populations (USDHHS, 2000b) because individuals in minority communities are more

likely to seek treatment from people of their own racial or ethnic background (Edmunds, 2006). Research also shows that increasing the diversity of our schools enhances the educational experience and increases the likelihood that dental school graduates will practice in ways that extend oral care services to all segments of society (Edmunds, 2006).

According to the South Carolina Office for Healthcare Workforce, Analysis and Planning Report (April 2012), almost 80% of the dentists were males, while 20.3% were females. Among all the dentists under the age of 35, female dentists counted for 51.5%. The racial and ethnic makeup of the dental workforce in South Carolina in 2011 compare to United States is presented in Table XIX.

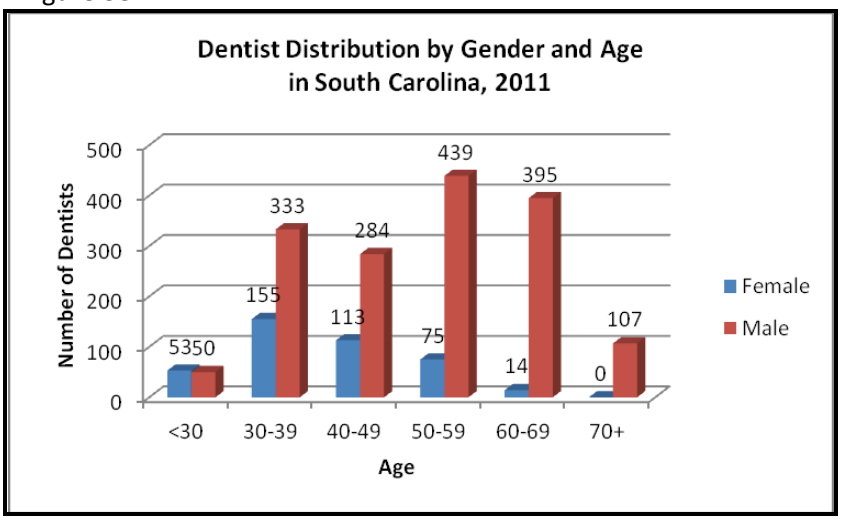
Table XIX: Dentist by Gender, Race and Ethnicity

	United States 2006	South Carolina 2011
Total active	180,000	2068
Gender		
Male	80	79.7
Female	20	20.3
Race/Ethnicity		
White	86.2	91
Black/ African American	3.4	6.1
Hispanic	3.4	0.3
Asian	6.9	1.3
American Indian	0.1	0.1

Source: SC Office for Healthcare Workforce Analysis and Planning (The Dentist Workforce Report 2012)
U.S. Data: Institute of Medicine (Current Demographics and Future Trends of the Dentist Workforce, 2009)

The average age of practicing dentists in South Carolina is 49.4. The aging trend may result in a large number of dentists retiring in the next 10 years without an adequate number of younger dentists to replace them, thus creating a shortage in dental workforce in the future. One quarter (25.5%) of dentists in South Carolina currently practicing are age 60 or older (Figure 38).

Figure 38



Source: SC Office for Healthcare Workforce Analysis and Planning (The Dentist Workforce Report 2012)

c. Use of Dental Services

i. General Population

Although appropriate home oral health care and population-based prevention are essential, professional care is also necessary to maintain optimal dental health outcomes. Regular dental visits provide an opportunity for the early diagnosis, prevention, and treatment of oral diseases and conditions for people of all ages, and for the assessment of self-care practices. Adults who do not receive regular professional care can develop oral diseases that eventually require complex treatment and may lead to tooth loss and health problems. People who have lost all their natural teeth are less likely to seek periodic dental care than those with teeth. This in turn decreases the likelihood of early detection of oral cancer or soft tissue lesions from medications, medical conditions, and tobacco use, as well as from poor-fitting or poorly maintained dentures.

Several indicators are used to measure the utilization of dental services such as routine dental visits or dental cleanings that the population receives within a period of time.

Routine Dental Visit Trend. Dental visits can detect early signs of oral health problems that can prevent further damage, and in some cases, reverse the problem. Over the past decade there has been a significant albeit steady decline in the proportion of SC adults who routinely visit an oral health professional for proper care. From 2001 to 2010 the percentage of annual dental visits decreased 12% from 70.6% to 62.1%. Annual dental visits trend over the past decade is shown in Figure 39. While little difference is noticed among men and women, a significant difference is seen among racial ethnic groups. As shown here, Non-Hispanic Black men and women are

significantly less likely, than are Non-Hispanic White men and women, to visit a dentist or other dental specialist for annual oral health checkups. This difference is shown in Figure 40.

Figure 39

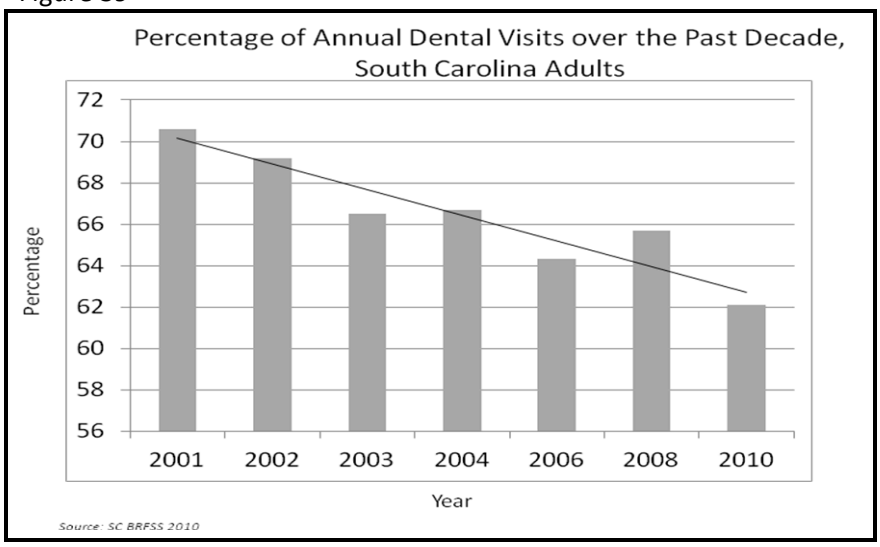
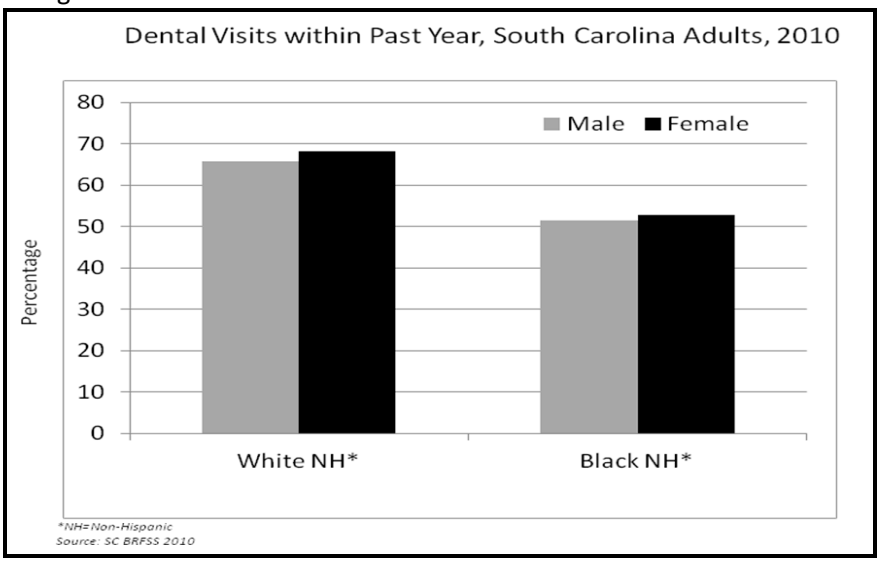


Figure 40



Persons that had their teeth cleaned in the last 12 months are shown in Table XX. Females and people with higher income and education level have the highest percentage of teeth cleanings in the last 12 months. This suggests that those people are more than likely to have dental insurance and/or could afford out of pocket dental expenses.

Table XX: Percentage of Adults Aged 18 Years or Older Who Had Their Teeth Cleaned Within the Past Year, BRFSS 2008

	United States (%)	South Carolina[a] Status (%)
Total	69	66.5
Age		
18 – 24 years	66.4	67.4
25 – 34 years	62.4	62.5
35 – 44 years	68.7	64.2
45 – 54 years	70.2	68.1
55 – 64 years	73.9	70.5
65 + years	74.2	68.1
Race		
White	72.3	72.7
Black	58.6	52.8
Hispanic	62	n/a
Other	64	n/a
Multiracial	56	n/a
Sex		
Male	66.6	64.7
Female	71.4	68.1
Education Level		
Less than high school	49.1	35.8
High school or G.E.D.	62	56.5
Some post high school	68.9	68.3
College graduate	80	84
Income		
Less than $15,000	46.8	36.3
$15,000 – 24,999	52.1	43
$25,000 – 34,999	60	56
$35,000 – 49,999	67.3	63.6
$50,000+	80.21	82.4

Table XX Sources:
Division of Adult and Community Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, *Behavioral Risk Factor Surveillance System Online Prevalence Data,* 2008. Available at www.cdc.gov/brfss.
[a] BRFSS 2008/South Carolina

ii. Special Populations

Schoolchildren / *Pregnant Women*

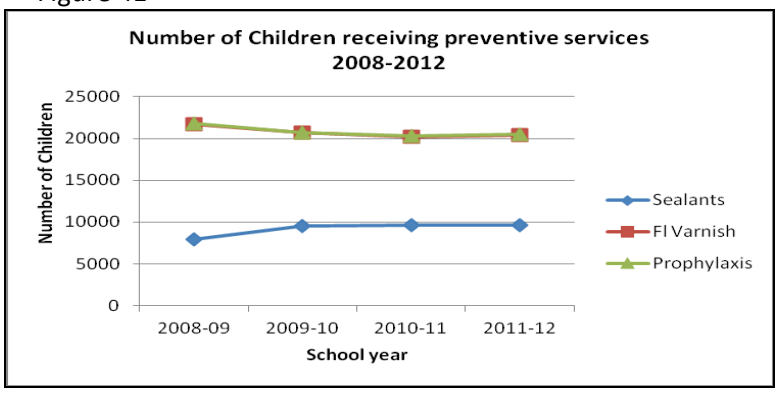
SC DHEC School Dental Program: Delivery of Preventive Dental Services in School-aged Children

The 2003 Dental Practice Act established the role of the SC DHEC to coordinate the public health dental prevention program delivered by public-private partnerships. The South Carolina SDPP is comprised of four dental programs that enter yearly into a Memorandum of Agreement with DHEC to deliver preventive dental services, including sealants, in public health settings. These programs serve children in schools with <40% of Free and reduced lunch. Programs such as Beaufort-Jasper-Hampton Comprehensive Health Services, Little River Medical Center, Health Promotion Specialists and Classy Smiles, reached 21,888 children in the 2011-2012 school year.

Another measure of utilization of dental services is the number of sealants, fluoride varnish and dental cleanings among school-aged children.

In the 2011-2012 school year, 9,596 children received one or more sealants on their permanent molars, 20,374 children received fluoride varnish and 20,489 children received prophylactic treatment. In the last 5 years 82,962 and 83,308 children received fluoride varnish and had their teeth cleaned, while 36,788 children had received sealants. During the period 2008-2012 we see that the number of children receiving all these preventive services have not changed substantially Figure 41.

Figure 41



Source: SC DHEC SDPP Annual Evaluation Report (2008-2012)

2012-2013 Oral Health Needs Assessment

Every five years DHEC conducts statewide dental screening to obtain a picture of the dental health of Kindergarten and 3rd grade children in South Carolina. The Statewide Oral Health Screening and Assessment not only can raise awareness about the connection between a healthy mouth and a healthy body, but also can help increase knowledge about preventive practices and access to dental care. The findings of the Oral Health Statewide Screening survey will be utilized to evaluate the State's preventive oral health programs, determine the need for additional dental

programs and describe the oral health status of South Carolina's children. A total of 76 schools in 37 school districts across 29 counties in the state participated in the survey. A variety of dental professionals and school nurses conducted screenings for 6515 students (SC DHEC, Division of Oral Health Database, 2013).

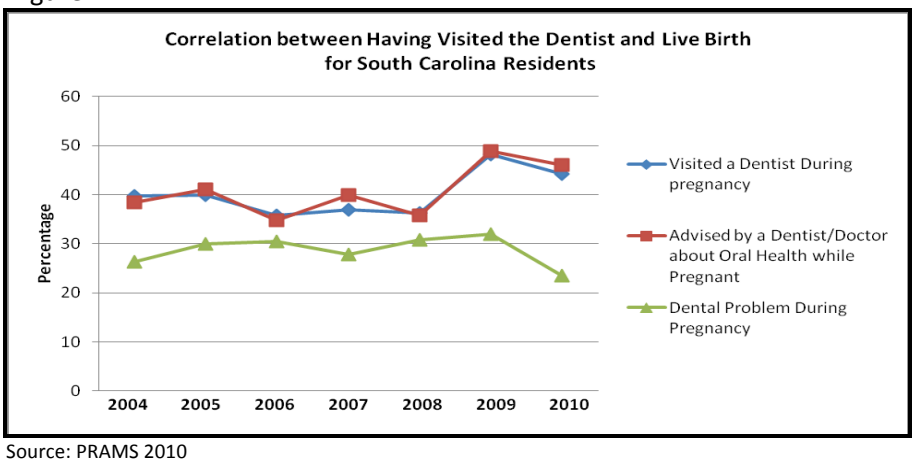
*Schoolchildren / **Pregnant Women***

Studies documenting the effects of hormones on the oral health of pregnant women suggest that 25–100 % of these women experience gingivitis and up to 10 % may develop more serious oral infections (Amar & Chung 1994; Mealey 1996). Recent evidence suggests that oral infections such as periodontitis during pregnancy may increase the risk of preterm or low birthweight deliveries (Offenbacher et al. 2001). During pregnancy, a woman may be particularly amenable to disease prevention and health promotion interventions that could enhance her health or that of her fetus (Gaffield et al. 2001).

It has been found that pregnant diabetic women have more gingival inflammation and deeper pockets between their teeth and gums, which are symptoms of periodontal disease, than non-diabetic pregnant women. These findings are significant because periodontal disease is a bacterial infection that may also make diabetes more difficult to control. Consequently, treating the periodontal disease may benefit diabetic control, as well as, pregnancy outcomes.

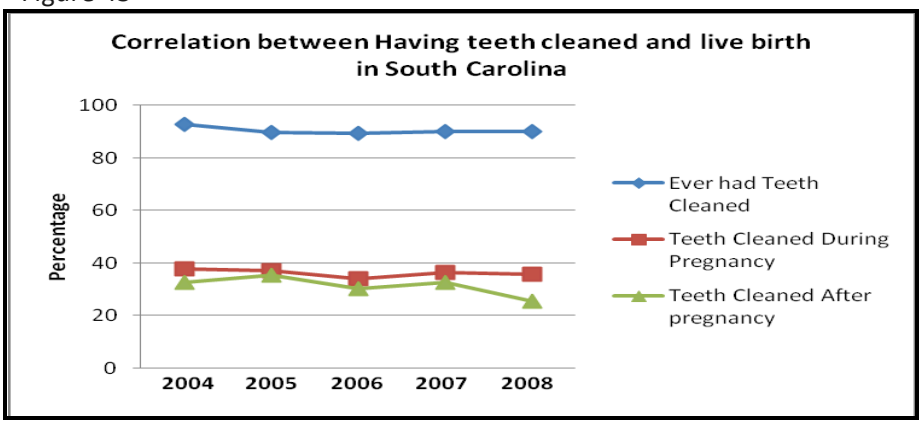
Maternal oral health seems to contribute to the birth weight of an infant. One possible explanation is that bacteria from the mother's mouth may get into her bloodstream and travel to the placenta, inducing premature labor. However, very little is known about the exact mechanism by which periodontal disease is linked to the birth outcome – and specifically, the birth weight – of an infant. Studies have shown that women with periodontal disease were between three and a half and seven times more likely than those who did not have periodontal disease to give birth to a preterm or low birth weight infant; periodontal treatment also significantly reduces the risk of having a preterm or low birth weight infant (Lopez, Smith, and Gutierrez, 2002; Lopez, Da Silva, Ipinza, and Gutierrez, 2005). Figures 42 and 43 show the correlation between visiting the dentist/having teeth cleaned during pregnancy and having live births.

Figure 42



Source: PRAMS 2010

Figure 43



Source: PRAMS 2008

A low birth weight baby is an infant that is born weighing less than 5.5 pounds, and a very low birth weight baby is one that weighs less than 3.3 pounds at birth.

In South Carolina in 2010, 14.2% of live births, 1 in 7 babies were born premature. Between 2000 and 2010 the rate increased more than 4%. This is higher than the national average of 12% percent (or 1 in 8 babies), and has been rising in the last few years. South Carolina ranks 47th out of 50 states for the rate of low birth weight. The problem is significantly greater among Blacks, whose low birth weight rate is 19% percent, compared with 12% and 12.5% of White or Hispanic babies, while the national average is 17.4; 10.9 and 12 percent respectively.
(March of Dimes 2010, accessed at:
http://www.marchofdimes.com/Peristats/ViewSummary.aspx?reg=45&stop=60).

d. Dental Medicaid and State Children's Health Insurance Programs

Medicaid is the primary source of health care for low-income families, the elderly and disabled persons in the United States. This program became law in 1965 and is jointly funded by the federal and state governments (including the District of Columbia and the Territories) to assist states in providing medical, dental, and long-term care assistance to people who meet certain eligibility criteria. People who are not U.S. citizens can receive Medicaid only to treat a life-threatening medical emergency; eligibility is determined on the basis of state and national criteria. Dental services are a required service for most Medicaid-eligible individuals under the age of 21 years, as a required component of the Early and Periodic Screening, Diagnostic and Treatment (EPSDT) benefit. Services must include, at a minimum, relief of pain and infections, restoration of teeth, and maintenance of dental health. Dental services may not be limited to emergency services for EPSDT recipients (Centers for Medicare & Medicaid Services, 2004).

Nationally, federal Medicaid expenditures for Medicaid totaled $2.3 billion in 2003, or three percent of the $74.3 billion spent on dental services nationally (Centers for Medicare & Medicaid Services 2004).

Medicaid provides health care coverage to nearly 30 million children while Children's Health Insurance Program (CHIP) covers an additional 6 million; together they provide coverage for 59% of low-income children (IOM, 2011. p. 3-7). Medicaid spending on dental services accounted for 1.3% of all Medicaid payments for the Fiscal year 2008 (IOM, 2011. p. 3-8). Robinson et al., (2000) stated, "The prevalence of dental caries disease means that financial cost of treating the disease worldwide is enormous" (p. 481).

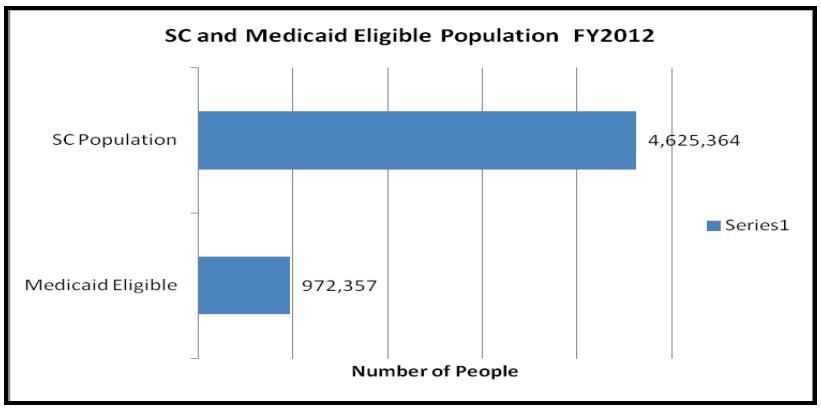
According to Pew Center on the States (State Fact Sheet 2011) South Carolina meets six of the eight policy benchmarks aimed at addressing children's dental health needs, one less than it achieved in 2010. The decline reflects that Medicaid rates have slipped relative to dentists' usual fees. Nonetheless, the percent of Medicaid-enrolled children receiving dental services has increased from 46.9 percent to 51.9 percent. The problem is too many children lack access to dental care, with severe outcomes. Almost half of the children on Medicaid received no dental service in 2009.

South Carolina provides fluoridated water to 93.8 percent of its residents and has sealant programs in over half of its high-risk schools. In 2010, the state enacted a new law to institute a targeted school-based dental screening and education program in several underserved counties. The law also establishes a "community oral health coordinator" to help connect children with dental treatment needs with a dental provider.

In South Carolina, 972,357 people are Medicaid eligible making up to 21% of the population Figure 44. A distribution of Medicaid members by eligibility is shown in Figure 45.

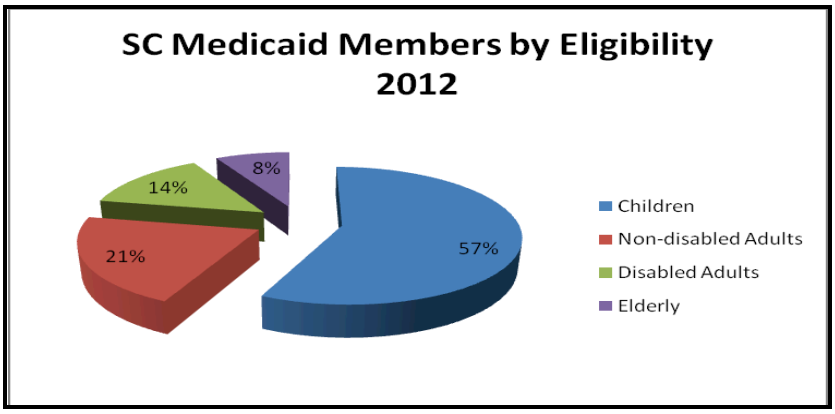
Almost 80% of Medicaid eligible population is comprised of children, elderly and disabled adults who are the most vulnerable population in the state.

Figure 44



Source: SC DHHS Report FY2012

Figure 45



Source: SC DHHS Report FY2012

In fiscal year 2011-2012 in South Carolina there were 492,177 children enrolled in Title XIX Medicaid for at least one month of the year and 126,955 children enrolled in Title XXI CHIP for at least one month of the year. Medicaid dental benefits cover only children up to 21 years of age and include all preventive, restorative, surgical, endodontic dental services with the exception of orthodontic treatments. There are no adult or pregnancy-related Medicaid dental benefits in South Carolina as well as no adult (19+years) CHIP dental benefits.

In 2012 there were 2485 dentists and 3090 dental hygienists licensed and residing in South Carolina. Medicaid/CHIP billing dentists were 781, while no dental hygienist can bill for services due to their scope of practice based on SC Code Ann 40-15-80.

There is one state agency with a dental program in South Carolina and 4 mobile dental clinics funded/ supported by the state.

e. Community and Migrant Health Centers and other State, County, and Local Programs

CHCs provide family-oriented primary and preventive health care services for people living in rural and urban medically underserved communities. CHCs exist in areas where economic, geographic, or cultural barriers limit access to primary health care. The MHP supports the delivery of migrant health services, serving more than 650,000 migrant and seasonal farm workers. Among other services provided, many CHCs and Migrant Health Centers provide dental care services.

Healthy People 2010 objective 21-14 is to "Increase the proportion of local health departments and community-based health centers, including community, migrant, and homeless health centers, that have an oral health component" (USDHHS 2000b). In 2002, 61 percent of local jurisdictions and health centers had an oral health component (USDHHS 2004b); the *Healthy People 2010* target was 75 percent.

In 2011-2012 fiscal year there were 265 Community-based Health Centers in South Carolina and 54 of them were Community-Based dental clinics that includes CHCs, hospitals and other

facilities that provide free or reduced dental services to population. According to the South Carolina Primary Health Care Association website, there are 19 FQHCs and one (1) statewide Migrant Health Voucher Program. Of the 19 FQHCs, seven (7) offer dental services in South Carolina. Those offering dental services are:

1. Beaufort-Jasper-Hampton Comprehensive Health Services, Inc.
   Website Info: http://www.bjhchs.org

2. CareSouth Carolina, Inc. (mobile dental)
   Website info: http://www.caresouth-carolina.com

3. Eau Claire Cooperative Health Centers, Inc.
   Website info: http://www.ecchc.org

4. Family Health Centers, Inc.
   Website info: http://www.myfhc.org

5. Little River Medical Center, Inc.
   Website info: http://littlerivermedcenter.com

6. New Horizon Family Health Services, Inc.
   Website info: http://newhorizonfhs.org

7. ReGenesis Health Care, Inc.
   Website info: http://myrhc.org

Most of the school-aged children are reached through SC SDPP that is comprised by two profit and non-profit organizations and two FQHCs (Beaufort-Jasper-Hampton Comprehensive Health Services, Inc and Little River Medical Center, Inc). There is one Dental School and six Dental Hygiene Programs in the State of South Carolina which also provide dental services as part of their clinical curriculum.

VII. Conclusions

South Carolina is doing very well at reducing some aspects of the burden of oral disease. Outreach programs funded by the DHEC for water fluoridation, Medicaid enrollment (which requires dental screening as a part of well-child checkups), and dental health education for children and parents have been particularly effective. However, there are many factors that could be improved and some areas that need to be addressed. For example South Carolina needs to establish a method of surveillance, so the oral disease burden could be tracked and understood more effectively.

What South Carolina Is Doing Well

- **Fluoridated Water**

One of the highlights of oral disease prevention in the state of South Carolina has been the ongoing effort to supply all municipalities with fluoridated water systems. South Carolina has exceeded the national goal of having 75 percent of households receive fluoridated water; 82 percent of the total population (and 93.8 percent of the population on public water systems) receives fluoridated water. With this high rate of fluoridation, South Carolina can look forward to a reduced prevalence of tooth decay, especially among populations with low access to care.

- **School Dental Prevention Programs**

School dental programs that provide access to dental treatment have been developed in several communities where access to dental care is an issue for the students. The school dental prevention program has been very successful in increasing access to dental sealants and fluoride varnish applications. During the 2011-2012 school year, there were four programs (Health Promotion Specialists, Classy Smiles, Beaufort-Jasper-Hampton Comprehensive Health Services and Little River Medical Center) throughout South Carolina providing at a minimum, dental preventive services to approximately 21,000 students.

- **Oral Health Needs Assessment 2012-2013**

Every five years SC DHEC conducts statewide dental screening to obtain a picture of the dental health of Kindergarten and 3rd grade children in South Carolina. The Statewide Oral Health Screening and Assessment not only can raise awareness about the connection between a healthy mouth and a healthy body, and subsequently help increase knowledge about preventive practices and access to dental care. The findings of the Oral Health Statewide Screening survey will be utilized to evaluate the State's preventive oral health programs, determine the need for additional activities and describe the oral health status of South Carolina's children. Data collected in previous assessments has been utilized both at the state and community level to improve the oral health of children, as well as developing a baseline to determine if the efforts to improve oral health are working, and what more could be done. A sample of 76 schools throughout the state in 29 counties was chosen for the survey and 6515 children K-5 and 3rd graders were screened. Data is being analyzed and an Evaluation Report will be available at DOH website.

- **Early Childhood and Oral Health**

South Carolina has built consensus and support for oral health standards of care for young children through a consistent and comprehensive approach. Some examples of this include the development and publication of clinical practice guidelines established by American Academy of Pediatrics and American Association of Pediatric Dentistry for early childhood oral health in South Carolina.; the creation and production of a Health Professionals (dental and medical) Office Toolkit for early childhood oral health that includes, but is not limited to, a screening chart, tooth eruption chart, risk assessment forms, and parent/caregiver education materials; and programming to strengthen the establishment of a dental home.

Specific resources have been developed and targeted technical assistance have taken place to address and support these initiatives as well. Some of the resources that have been developed and utilized include: certified *Oral Health 101* trainings for childcare providers; the *Oral Health Care for Pregnant Women* Guidelines; *SC Takes Action: Oral Health for the Young Child***;** *Oral Health Teacher Activities for the Early Childhood Classroom* booklet; an Oral Health Puppet Show that travels across the state to schools and Head Start Centers; *Oral Health Parent Information* booklet; *First Birthday Card* Campaign**;** and a Head Start Oral Health Tool Kit for Health Coordinators.

The focus is a collaborative and community approach that includes internal and external partners to improve the oral health status of South Carolina's young children. Partners are both traditional and non-traditional entities including Health Educators; Women, Infants and Children Program (WIC) Nutritionists; Early Head Start/Head Start Health Coordinators; outreach workers from Community Health Centers and Managed Care Organizations; EdVenture Children's Museum and other community outreach programs.

Strong partnerships and consistent focused messaging have helped South Carolina meet the objectives within the SOHP and subsequently establish resources and networks that support improved oral health for young children.

- **Families with Children with Special Healthcare Needs**

Children with special health care needs are almost twice as likely to have unmet oral health care needs as their peers without special health care needs across all income levels. South Carolina has taken a collaborative approach to address the oral health needs of these families. Beginning with the dental professional, the South Carolina Dental Association (SCDA) and the South Carolina Oral Health Coalition established an award to honor a dentist for excellence in providing care to and advocacy for individuals with special health care needs. This annual award began in 2007 and is the first of its kind. It is co-sponsored by Specialized Care Company, and nominations are accepted through the DOH. The recipient is recognized at the Medical University of South Carolina (MUSC) in Charleston and at the annual SCOHACC Oral Health Forum. The true intent of this award is to increase awareness of the need and acknowledgement for the efforts dental professionals who serve individuals with special needs.

In an effort to reach and support families, South Carolina has developed educational resources. These resources have been in existence since 2007 and were revised in 2012 after being reviewed from a clinical and parental perspective. The materials are distributed on an ongoing

basis to families as well as dental professionals to raise awareness about the oral health needs of families with special health care needs. Distribution to the public takes place on an ongoing basis at outreach events held through Family Connection SC, a parent support group that sponsors an annual statewide conference as well as through EdVenture Children's Museum who also targets their programming to address the needs of families with special needs. A new partner is Camp Burnt Gin. This camp for children with special needs is held each summer. Members of the SCOHACC conduct oral health training for the camp counselors. This training enables the counselors to support positive oral health behaviors and education for campers who attend the camp each year.

Sound partnerships and a consistent focused approach targeting dental professionals and families with special needs have helped South Carolina meet the number one unmet need of children with special healthcare needs. For more information on these resources and programs, http://www.scdhec.gov/health/mch/oral/special.htm

- **Surveillance**

The first surveillance plan was produced in 2004. It has undergone several revisions to incorporate enhanced data collection strategies since that time. The surveillance system drives the objectives and activities of the SOHP. The South Carolina surveillance system is used to assist in the measurement of data-driven measures of the SOHP. In essence, it is the plan for monitoring the success of the SOHP. The data is used to (1) measure the burden of oral disease, (2) to monitor progress towards the SOHP objectives, and (3) to provide information for needed action at the national, state and local levels. The Office of Research and Statistics has partnered with the DOH and has created a surveillance module that tracks all Medicaid and Medicare claims for oral health. This endeavor should provide key oral health data on disadvantaged groups. The Division of Oral Health has recently developed multiple ACCESS databases to house and utilize active and passive surveillance data. The presence of these databases enables the Division to have the latest and most accurate data on hand for addressing oral health issues and development of policy for prevention endeavors.

- **Tobacco Control**

Tobacco control is a health issue for all South Carolinians. Nearly 14 percent of South Carolina residents smoke every day, and an additional 7 percent smoke on at least some days (BRFSS, 2010). This is in line with the national rates. DHEC has recently established the Tobacco Quitline, a toll-free phone number that state residents can call to receive individualized cessation counseling. The program does include an oral health component, where the "QuitCoach" discusses the impact of tobacco on teeth, gums, breath, and the risk of oral cancer with the client. The program is also available as a web-based counseling program. Tobacco use is addressed within the SC Health and Safety Standards and is included in health curricula. In addition, supplemental curricula materials are available to school districts.

Areas in which South Carolina Needs to Invest

- **Access to Care**

Access to medical care, especially dental care, continues to plague poor, rural South Carolinians. Transportation issues, availability of dental providers who accept Medicaid are problems many counties in South Carolina continue to face. Adult dental services are no longer available. According to the Pew Center on the States (State Fact Sheet 2011), South Carolina meets six of the eight policy benchmarks aimed at addressing children's dental health needs, one less than it achieved in 2010. The problem is too many children lack access to dental care with severe outcomes. Almost half of the children on Medicaid received no dental service in 2009. All states fall short of HP2010 target in dental sealants and South Carolina is one of them. In 2012 South Carolina Received Grade C from the Pew Center on the States meeting only 7 out of 11 benchmarks falling short in:

- increase of high-need schools with sealants program with 24-49% (target 75%+)
- sealants with 23.9% (target 50%)

More work is needed in increasing the number of children receiving dental sealants in school setting.

- **Education and Training of Healthcare Providers**

Educating and training healthcare providers is an important component of strengthening the safety net. It is also important for providers to connect with the communities where they practice and reside. Also, informing their patients about the connections of oral health to the overall health with emphasis to the connection of tobacco use – to oral cancer and periodontal disease; Gum disease to low weight and premature birth; periodontal disease to heart disease and diabetes etc, would empower their patients to better care for their mouths. Education is also needed about the importance of water fluoridation and how to promote and advocate it in the community, especially when community has shown concerns about it.

- **Diversity of the Workforce**

Little progress had been made in diversifying the dental workforce of South Carolina. The dental workforce faces challenges in South Carolina including: a lack of racial and ethnicity diversity; the majority of dentists will retire in the next decade; and less dentists in rural areas. South Carolina does have more minority dental providers than the national average; however, they are still a very small proportion of the total workforce. Recruiting more minority dental providers could contribute to the elimination of oral health disparities in our state.

Areas in Which South Carolina Needs to Expand Surveillance Programs

- **Surveillance**

Standardization of surveillance methods would be helpful. For example, South Carolina uses a four-stage delineation of oral cancer spread at detection (in situ, invasive, late stage, and early stage), while *Healthy People 2010* and the American Cancer Society use three-stage delineation (localized, distant, and invasive) with definitions that are very different. Similarly, the American Heart Association measures cardiovascular disease while *Healthy People 2010* measures coronary heart disease, angina pectoris, and myocardial infarctions. It is difficult to compare state and national rates if they are measuring different conditions, or if conditions are defined differently.

Future Directions for South Carolina

The DOH is continually updating the SOHP to ensure that it is responsive to and reflective of the needs that exist in the state. Even though some changes have been made in the priorities and in the objectives, the overall goal remains the same: to improve the oral health of all residents in South Carolina.

VIII. References

Ahovuo-Saloranta, A., A. Hiiri, A. Nordblad, H. Worthington, and M. Mäkelä. 2008. Pit and fissure sealants for preventing dental decay in the permanent teeth of children and adolescents. *Cochrane Database of Systematic Reviews* (4):CD001830.

Amar S, Chung KM. Influence of hormonal variation on the periodontium in women. *Periodontol 2000*:1994;6:79–87.

American Academy of Pediatric Dentistry. (2009). Guideline on Periodicity of Examination, Preventive Dental Services, Anticipatory Guidance/Counseling, and Oral Treatment for Infants, Children, and Adolescents. *Reference Manual: Clinical Guidelines,* 33(6), 102-108.

American Academy of Periodontology. Position paper: Tobacco use and the periodontal patient. *J Periodontol* 1999;70:1419–27.

American Dental Association. *Distribution of Dentists in the United States by Region and State*, 1997. Chicago, IL: American Dental Association Survey Center; 1999.

American Cancer Society. *Tobacco and Cancer*.
Accessed at: http://www.cancer.org/docroot/ped/content/ped

Bailey W, Duchon K, Barker L, Maas W. Populations receiving optimally fluoridated public drinking water – United States, 1992–2006. *MMWR* 2008; 57(27):737–741.
Available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5727a1.htm

Beck JD, Offenbacher S, Williams R, Gibbs P, Garcia R. Periodontics: A risk factor for coronary heart disease? *Ann Periodontol* 1998;3(1):127–41.

Bird, L. D. and Robinson, S. D. (2002). *Torres and Ehrlich Modern Dental Assisting* (7th ed.). Philadelphia, PA: Saunders.

BPHC.HRSA.gov [Internet]. Rockville, MD: The Health Center Program: What Is A Health Center [last reviewed 2009 Aug 24; cited 2010 March 8th].
Available at http://bphc.hrsa.gov/about/.

Brown LJ, Wagner KS, Johns B. Racial/ethnic variations of practicing dentists. *J Am Dent Assoc* 2000;131:1750–4.

Burt BA, Eklund BA. *Dentistry, dental practice, and the community*. 5th ed. Philadelphia: WB Saunders; 1999.

Casamassimo, S. P., Thikkurissy, S., Edelstein, L. B. and Maiorini, E. (2009). Beyond the DMFT: The Human and Economic Cost of Early Childhood Caries. *The Journal of American Dental Association,* 140(6), 650-657.

Centers for Disease Control and Prevention. Preventing and controlling oral and pharyngeal cancer. Recommendations from a national strategic planning conference. *MMWR* 1998; 47(No. RR-14):1–12.
Available at http://www.cdc.gov/mmwr/preview/mmwrhtml/00054567.htm.

Centers for Disease Control and Prevention. Achievements in public health, 1900–1999: Fluoridation of drinking water to prevent dental caries. *MMWR* 1999;48(41):933–40.
Available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4841a1.htm.

Centers for Disease Control and Prevention. Populations receiving optimally fluoridated drinking water — United States, 2000. *MMWR* 2002;51(7), 144-7.
Available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5107a2.htm.

Centers for Disease Control and Prevention. Recommendations for using fluoride to prevent and control dental caries in the United States. *MMWR Recomm Rep* 2001;50(RR-14):1–42.
Available at http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5014a1.htm.

Centers for Disease Control and Prevention. Annual smoking-attributable mortality, years of potential life lost, and economic costs—United States, 1995–1999. *MMWR* 2002;51(14):300–3.
Available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5114a2.htm.

Centers for Disease Control and Prevention 2008, *Behavioral Risk Factor Surveillance System Online Prevalence Data,* 2008, accessed at: www.cdc.gov/brfss

Center for Disease Control and Prevention, 2010, *Behavioral Risk Factor Surveillance System Online Prevalence Data,* 2010, accessed at: www.cdc.gov/brfss

Centers for Disease Control and Prevention. Smoking-Attributable Mortality, Years of Potential Life Lost, and Productivity Losses—United States, 2000–2004**.** *Morbidity and Mortality Weekly Report 2008*, 57(45), p.1226–1228.
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5745a2.htm

Centers for Disease Control and Prevention. State highlights: Tobacco use.
Accessed at: http://www.cdc.gov/tobacco/

Centers for Disease Control and Prevention, Youth Risk Behavior Surveillance System Online. YRBSS 2011 available at http://apps.nccd.cdc.gov/YouthOnline/App/Results.

Centers for Disease Control and Prevention, *Heart Disease Facts* accessed at:
http://www.cdc.gov/heartdisease/facts.htm

Centers for Disease Control and Prevention, *Heart Disease and Stroke Prevention: Heart and Stroke Maps* accessed at http://apps.nccd.cdc.gov/NCVDSS_DTM/

Centers for Disease Control and Prevention, *Healthy People 2010 Database,* accessed at: http://wonder.cdc.gov/scripts/broker.exe

Centers for Disease Control and Prevention, 2011, *National Diabetes Fact Sheet,* accessed at: http://www.cdc.gov/diabetes/pubs/factsheet11.htm

Centers for Disease Control (2012), *Fluoridation Statistics*. Accessed at: http://www.cdc.gov/fluoridation/statistics.htm

Centers for Medicare & Medicaid Services. National Health Expenditure (NHE) amounts by type of expenditure and source of funds: Calendar years 1965–2013. Updated October 2004. [Updated version: Centers for Medicare & Medicaid Services. National Health Expenditure (NHE) amounts by type of expenditure and source of funds: Calendar years 1965–2019. Available at http://www.cms.hhs.gov/NationalHealthExpendData/03_NationalHealthAccountsProjected.asp#TopOfPage.

Christen AG, McDonald JL, Christen JA. The impact of tobacco use and cessation on nonmalignant and precancerous oral and dental diseases and conditions. Indianapolis, IN: Indiana University School of Dentistry; 1991.

Dasanayake AP. Poor periodontal health of the pregnant woman as a risk factor for low birth weight. *Ann Periodontal* 1998;3:206–12.

Davenport ES, Williams CE, Sterne JA, Sivapathasundram V, Fearne JM, Curtis MA. The East London study of maternal chronic periodontal disease and preterm low birth weight infants: Study design and prevalence data. *Ann Periodontol* 1998;3:213–21.

Fiore MC, Bailey WC, Cohen SJ, et al. Treating tobacco use and dependence. Clinical practice guideline. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service; 2000. Available at http://www.surgeongeneral.gov/tobacco/treating_tobacco_use.pdf.

Francisco, M. E., Azevedo, S., Young, D. A., (2009, February). Caries Management for the whole family: Implementing Cambra into your practice [Electronic version]. *Dimensions of Dental Hygiene,* 7(2), 34-37.

Gaffield ML, Gilbert BJ, Malvitz DM, Romaguera R. Oral health during pregnancy: An analysis of information collected by the pregnancy risk assessment monitoring system. *J Am Dent Assoc* 2001;132(7):1009–16. Full text available at: http://jada.ada.org/cgi/content/full/132/7/1009.*

Genco RJ. Periodontal disease and risk for myocardial infarction and cardiovascular disease. *Cardiovasc Rev Rep* 1998;19(3):34-40.

Green, L.W. and Kreuter, M. (2004). Health Program Planning: An Educational and Ecological Approach (4th Ed.). New York: McGraw-Hill

Griffin SO, Jones K, Tomar SL. An economic evaluation of community water fluoridation. *J Public Health Dent* 2001;61(2):78–86.
Abstract available at http://www.ncbi.nlm.nih.gov/pubmed/11474918?dopt=AbstractPlus.

Griffin, S. O., E. Oong, W. Kohn, B. Vidakovic, B. F. Gooch, J. Bader, J. Clarkson, M. R. Fontana, D. M. Meyer, R. G. Rozier, J. A. Weintraub, and D. T. Zero. 2008. The effectivenessof sealants in managing caries lesions. *Journal of Dental Research* 87(2):169-174

Gupta, Prakash, C., (September 10, 2001).The public health impact of tobacco. *Current Science,* 81(5). p. 475-481. http://www.ias.ac.in/currsci/sep102001/475.pdf

Hicks, J., Garcia-Godoy, F. and Flaitz, C. (2004). Biological Factors in Dental Caries: Role of Remineralization and Fluoride in the Dynamic Process of Demineralization and Remineralization. *Journal of Clinical Pediatric Dentistry,* 28(3), 203-214

Institute of Medicine, *Current Demographics and Future Trends of the Dentist Workforce, 2009.* Accessed at: http://www.iom.edu/Reports/2009/OralHealthWorkforce.aspx

Institute of Medicine. (2011). *Advancing Oral Health in America.* 2011 Report. Washington, DC: The National Academies Press.
Retrieved from: http://www.nap.edu/catalog.php?record_id=13086

International Agency for Research on Cancer (IARC). IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 89, Smokeless tobacco and some tobacco-specific *N*-nitrosamines. Lyon, France: World Health Organization, International Agency for Research on Cancer; 2007. Available at http://monographs.iarc.fr/ENG/recentpub/mono89.pdf.*

Johnson NW. *Oral Cancer*. London: FDI World Press, 1999.

Kaiser Family Foundation. Statehealthfacts.org. Retrieved from: http://www.statehealthfacts.org/

Kenney, M. G., McFeeters, R. J. and Yee, Y. Y. (August 2005). Preventive Dental Care and Unmet Dental Needs Among Low- Income Children. *American Journal of Public Health,* 95(8), 1360-1366

Komaromy M, Grumbach K, Drake M, Vranizan K, Lurie N, Keane D, Bindman AB. The role of Black and Hispanic physicians in providing health care for underserved populations. *N Engl J Med* 1996;334(20):1305–10.

Kressin NR, De Souza MB. Oral health education and health promotion. In: Gluck GM, Morganstein WM (eds). *Jong's Community Dental Health*, 5th ed. St. Louis, MO: Mosby; 2003:277–328.

Levi F. Cancer prevention: Epidemiology and perspectives. *Eur J Cancer* 1999;35(14):1912–24.

Lopez, Smith, and Gutierrez (2002). Higher Risk of Preterm Birth and Low Birth Weight in Women with Periodontal Disease. *Journal of Dental Research*, 81(1): 58-63.

Lopez, Da Silva, Ipinza, and Gutierrez (2005). Periodontal Therapy Reduces the Rate of Preterm Low Birth Weight in Women with Pregnancy-Associated Gingivitis. *Journal of Periodontology,* 76 (11 supplement): 2144-2215.

Martin, A. B., Vyavaharkar, M., Veschusio, C., Kirby, H., 2012, Rural-Urban Differencies in Dental Service Utilization Among an Early Childhood Population Enrolled in South Carolina Medicaid. *Maternal and Child Health Journal*, 16, p. 203-211. DOI: 10.1007/s10995-010-0725-1

Martin, A. B., Gallagher, A., Probst, J. C., Dental Sealant Utilization among Rural and Urban Children. *South Carolina Rural Health Research Center;* 2013, p.1-14.
Accessed at: http://rhr.sph.sc.edu/report/(92)Fact%20Sheet%20Dental%20Sealants.pdf

Mealey BL. Periodontal implications: medically compromised patients. *Ann Periodontol* 1996;1(1):256–321.

Morse DE, Pendrys DG, Katz RV, et al. Food group intake and the risk of oral epithelial dysplasia in a United States population. *Cancer Causes Control* 2000;11(8):713-20.

National Cancer Institute, *Sate Profiles,* accessed at: http://statecancerprofiles.cancer.gov/

National Center for Children in Poverty, 2010, accessed at:
http://www.nccp.org/profiles/SC_profile_16.html

National Health Interview Survey (NHIS): http://www.cdc.gov/nchs/nhis.htm,

National Health and Nutrition Examination Survey (NHANES):
Accessed at: http://www.cdc.gov/nchs/nhanes.htm.

National and state data on Behavioral Risk Factor Surveillance System (BRFSS), 2008:
Accessed at: http://www.cdc.gov/brfss

National data on National Youth Tobacco Survey: Accessed at:
http://www.cdc.gov/tobacco/Data_statistics/surveys/nyts/index.htm

National and state data on Youth Risk Behavioral Surveillance System: Accessed at:
http://apps.nccd.cdc.gov/youthonline/App/QuestionsOrLocations.aspx?CategoryId=2

Offenbacher S, Jared HL, O'Reilly PG, Wells SR, Salvi GE, Lawrence HP, et al. Potential pathogenic mechanisms of periodontitis associated pregnancy complications. *Ann Periodontol* 1998;3(1):233–50.

Offenbacher S, Lieff S, Boggess KA, Murtha AP, Madianos PN, Champagne CM, et al. Maternal periodontitis and prematurity. Part I: Obstetric outcome of prematurity and growth restriction. *Ann Periodontol* 2001;6(1):164–74.

Phelan JA. Viruses and neoplastic growth. *Dent Clin North Am* 2003;47(3):533–43.

Redford M. Beyond pregnancy gingivitis: Bringing a new focus to women's oral health. *J Dent Educ* 1993;57(10):742–8.

Reeves, S., Bernstein, I., (2008). Effects of Maternal Tobacco-Smoke Exposure on Fetal Growth and Neonatal Size. *Expert Review of Obstetrics & Gynecology,* 3(6), p. 719-730. http://cme.medscape.com/viewarticle/583680

Ries LAG, Eisner MP, Kosary CL, Hankey BF, Miller BA, Clegg L, et al. (Eds). SEER Cancer Statistics Review, 1975–2001, National Cancer Institute: Bethesda, MD; National Cancer Institute; 2004. Available at http://seer.cancer.gov/csr/1975_2001/.

Robinson, C., Shore, C. R., Brookes, J. S., Strafford, S., Wood, R.S. and Kirkham, J. (2000). The Chemistry of Enamel Caries. *Critical Reviews in Oral Biology & Medicine*, 11(4), 481-495.

Scannapieco FA, Bush RB, Paju S. Periodontal disease as a risk factor for adverse pregnancy outcomes. A systematic review. *Ann Periodontol*. 2003;8(1):70–8.

South Carolina Department of Health and Human Services, *Medicaid Reporting by County Statistics FY2012 Q2,* available at https://www.scdhhs.gov/reports-statistics

South Carolina, Department of Health and Environmental Control, BRFSS 2010, accessed at: http://www.scdhec.gov/hs/epidata/brfss_index.htm

South Carolina Code of Laws, Title 44, Chapter 8. (2010). Community Oral Health Coordinator. Retrieved on 10/20/2011 from: http://www.scstatehouse.gov/code/t44c008.php

South Carolina Dental Practice Act 40-15. South Carolina Code of Laws. Retrieved on 10/20/2011 from: http://www.scstatehouse.gov/code/t40c015.php

South Carolina, Department of Health and Human Services, *Fiscal Year 2012 Report: Q1,Q2* Accessed at: https://www.scdhhs.gov/reports-page/fy-2012-q1-proviso-2148

South Carolina, Department of Health and Environmental Control, Division of Oral Health, *State Oral Health Plan*. Accessed at: http://www.scdhec.gov/health/mch/oral/plan.htm

South Carolina, Department of Health and Environmental Control, Public Health Statistics and Information Services: *Pregnancy Risk Assessment Monitoring System* [PRAMS], 2008, accessed at: https://www.scdhec.gov/co/phsis/biostatistics/index.asp?page=prams

South Carolina, Department of Health and Environmental Control, Public Health Statistics and Information Services: *Pregnancy Risk Assessment Monitoring System* [PRAMS], 2010, accessed at: https://www.scdhec.gov/co/phsis/biostatistics/index.asp?page=prams

South Carolina Office for Healthcare Workforce Analysis and Planning, *The Dentist Workforce In South Carolina Report,* 2012, accessed at: http://www.officeforhealthcareworkforce.org/

South Carolina Office of Research and Statistics. Health and Demographics: About Us. *SC Budget and Control Board, Office of Research and Statistics,* Columbia, SC. Retrieved from: http://ors.sc.gov/hd/about.php

Taylor GW. Bidirectional interrelationships between diabetes and periodontal diseases: An epidemiologic perspective. *Ann Periodontol* 2001;6(1):99–112.

The Pew Center on the States. (February 2010). The Cost of Delay: State Dental Policies Fail One in Five Children. Retrieved from: http://www.pewcenteronthestates.org/uploadedFiles/Cost_of_Delay_web.pdf

Tomar SL, Asma S. Smoking-attributable periodontitis in the United States: Findings from NHANES III. *J Periodontol* 2000;71:743–51.

Tomar SL, Husten CG, Manley MW. Do dentists and physicians advise tobacco users to quit? *J Am Dent Assoc* 1996;127(2):259–65.

U.S Census Bureau, 2010 Census of Population and Housing, Population and Housing Unit Counts. Accessed at: http://quickfacts.census.gov/qfd/states/45000.html

United States Department of Agriculture, Data Products: *Atlas of Rural and Small Town America, 2010,* accessed at: http://www.ers.usda.gov/data-products/atlas-of-rural-and-small-town-america.aspx

U.S. Department of Health and Human Services. *The Health Consequences of Using Smokeless Tobacco: A Report of the Advisory Committee to the Surgeon General*. Bethesda, MD: U.S. Department of Health and Human Services, Public Health Service; 1986. NIH Publication No. 86-2874.

U.S. Department of Health and Human Services. *Current Estimates from the National Health Interview Survey, 1996.* Series 10, No. 200. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics; 1999. DHHS Publication No. 99-1528.
Available at http://www.cdc.gov/NCHS/data/series/sr_10/sr10_200.pdf.

U.S. Department of Health and Human Services. *Oral Health in America: A Report of the Surgeon General.* Rockville, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Dental and Craniofacial Research; 2000a. NIH Publication No. 00-4713.

U.S. Department of Health and Human Services. Oral Health. In: *Healthy People 2010,* 2nd edition. With Understanding and Improving Health and Objectives for Improving Health. 2 vols. Washington, DC: U.S. Government Printing Office; 2000b.

U.S. Department of Health and Human Services. *National Call to Action to Promote Oral Health*. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Dental and Craniofacial Research; 2003. NIH Publication No. 03-5303.

U.S. Department of Health and Human Services. *The health consequences of smoking: A report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2004a.
Available at http://www.surgeongeneral.gov/library/smokingconsequences/.

U.S. Department of Health and Human Services. *Healthy People 2010 progress review: Oral Health.* Washington, DC: U.S. Department of Health and Human Services, Public Health Service; 2004b. Available at http://www.healthypeople.gov/data/2010prog/focus21/.

University of South Carolina. Healthy Carolina. Accessed at:
http://www.sc.edu/healthycarolina/tobfree.html

Veschusio, C., Brock –Martin, A. OHNA 2007-2008. *Oral Health Status of School-Aged Children in South Carolina.* [PowerPoint Slides]. Retrieved from:
http://www.nationaloralhealthconference.com/docs/presentations/2009/0420/State%20Surveillance%20and%20NOHSS%20Part%20I%20-%20The%20Basic%20Screening%20Survey%209%20Years%20Later%20-%20A%20Brock%20Martin.pdf

Vineis, P., (2008). Smoking and Impact on Health. *European Respiratory Review*, 17(110), p.182-186. DOI: 10.1183/09059180.00011002 [Retrieved June 21, 2010].
http://err.ersjournals.com/cgi/reprint/17/110/182I

Weaver RG, Ramanna S, Haden NK, Valachovic RW. Applicants to U.S. dental schools: An analysis of the 2002 entering class. *J Dent Educ* 2004;68(8):880–900.

Wilkins, M. Esther, (2005). *Clinical Practice of the Dental Hygienist* (9th ed.). Baltimore, MD: Lippincott Williams & Wilkins.

Young, D. A., Featherstone, J. D. B., Roth, J. R., (2007, October). Curing the silent epidemic: Caries management in the 21st century and beyond [Electronic version]. *CDA Journal,* 35(10), 681-685.

IX. Appendices

ABBREVIATIONS

Abbreviation	Explanation
AHEC	Area Health Education Consortium
ASTDD	Association of State and Territorial Dental Directors – an affiliate of ASTHO
ASTHO	Association of State and Territorial Health Officers
BRFSS	Behavioral Risk Factor Surveillance System
BSS	Basic Screening Survey – developed by ASTDD workgroup with support from CDC
CDC	Centers for Disease Control and Prevention
CDI	Chronic Disease Indicators
CHEA	South Carolina's Comprehensive Health Education Act of 1988
CHC	Community Health Center
CHIP	Children's Health Insurance Program
DHEC	South Carolina Department of Health and Environmental Control
DHHS	Department of Health and Human Services
DOH	Division of Oral Health
EPSDT	Early and Periodic Screening, Diagnostic and Treatment
FQHC	Federally Qualified Health Center
FPL	Federal Poverty Level
HP2010	*Healthy People 2010*
HP2020	*Healthy People 2020*
HPV	Human Papilloma Virus
HRSA	Health Resources and Services Administration
MEPS	Medical Expenditure Panel Survey
MHP	Migrant Health Program
MMWR	Mortality and Morbidity Weekly Report
MUSC	Medical University of South Carolina
NCCP	National Center for Children in Poverty
NCHA	National College Health Assessment
NHANES	National Health and Nutrition Examination Survey
NHIS	National Health Interview Survey
NIH	National Institutes of Health
NOHSS	National Oral Health Surveillance System
NVSS	National Vital Statistics System
ORS	Office of Research and Statistics (SC)
PRAMS	Pregnancy Risk Assessment Monitoring System
SBDSP	School-Based Dental Sealant Program
SC	South Carolina
SC SCAN	South Carolina Community Assessment Network
SCDA	South Carolina Dental Association
SCOHACC	South Carolina Oral Health Advisory Council and Coalition
SCRHRC	South Carolina Rural Health Research Center
SDPP	School Dental Prevention Program

Abbreviation	Explanation
SEER	Surveillance and Epidemiology End Results
SOHP	State Oral Health Plan
US	United States
WFRS	Water Fluoridation Reporting System
WHO	World Health Organization
WIC	Women, Infants, and Children
YRBSS	Youth Risk Behavior Surveillance System

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